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PESTICIDES ABSTRACTS

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U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
MANAGEMENT SUPPORT DIVISION
Rm. E447, 401 M Street, S.W.
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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstracts Bulletin) is a monthly publication of the Management Support Division of the Office of Pesticides and Toxic Substances, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

Publication of an abstract, annotation, or citation does not imply endorsement by the Environmental Protection Agency of the original article or of commercial materials, equipment, or processes mentioned therein.

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81-3001. Leng, M. L. (Health & Environ. Sci., Dow Chem. Co., Midland, MI 48640) Discussion groups and workshops: a report. *ACS Symp. Ser.* 160(CH37): 553-562; 1981 (8 references).

In eight informal workshops sponsored by the Division of Pesticide Chemistry, the role of the pesticide chemist in relation to modern toxicology is discussed. Summaries from groups focusing on a particular subject are presented; comments on EPA Guidelines for *Good Laboratory Practice in Hazard Evaluation*, the analytical *vs.* toxicological view of metabolite significance, and re-entry standards for farm worker safety are considered. Other discussions question the feasibility of the EPA's process of Rebuttable Presumption Against Registration and recommended changes in EPA guidelines for subchronic toxicity testing. Evaluations of pesticide mutagenicity/carcinogenicity testing and methods of communicating technical information were made by other workshop groups.

81-3002. Balicka, N.; Wegrzny, T. (Inst. Agric. Chem. Soil Sci. & Microbiol., Agric. Acad. Wroclaw, PL-50-357 Wroclaw, Poland) Effect of microorganisms on the phytoxicity of herbicides. VI. Modification of Venzar activity by bacterial cultures. *Acta Microbiol. Pol.* 30(2): 195-201; 1981 (10 references).

Tests were designed to compare 2 bacterial strains (*Bacillus subtilis* 72 and *Arthrobacter* sp 18) that are capable of modifying the activity of the herbicide Venzar (lenacil) in different ways. *B. subtilis* has been shown to increase Venzar phytotoxicity, while *Arthrobacter* is known to decrease the phytotoxicity. Various bioassays were carried out to determine the effects on Venzar activity. In addition, Venzar was suspended in bacterial culture, and the amount taken up by plant seedlings was determined by TLC and radioactivity of ^{14}C-labeled herbicides. The results show that various mechanisms are responsible for the increase or decrease in herbicidal activity. The increased Venzar phytotoxicity due to *B. subtilis* may be due to disturbance in cell wall permeability and to water circulation disturbance due to the ammonia release by the bacteria. *Arthrobacter* was shown to decrease Venzar phytotoxicity, possibly due to some conjugation process between bacterial polypeptides and the carrier of lenacil.

81-3003. Brady, N. C., ed. (Int. Rice Res. Inst., Manila, Philippines) Advances in Agronomy. *Adv. Agron.* 31: 309 pp.; 1979.

In this book current topical information is provided to the international agronomy community. The effects of pesticides on soil microorganisms are discussed. Basic soil properties, including factors affecting root exudation, are considered. Red clover breeding and genetics are discussed. Reviews of factors affecting the loss of ammonia from soils and boron nutrition are also presented. Abstracts of chapters from this book will appears in the appropriate sections of this issue of *Pesticides Abstracts.*

81-3004. Hale, M. G.; Moore, L. D. (Dep. Plant Pathol. & Physiol., Virginia Polytechnic Inst. & State Univ., Blacksburg, VA) Factors affecting root exudation II: 1970-1978. *Adv. Agron.* 31: 93-124; 1979 (140 references).

Information on the factors affecting root exudation published during 1970-1978 is discussed. The plant factors considered are growth, injury, and ontogenetic development. Environmental factors considered included water stress, mechanical forces, and environmental pollution. The foliar application of chemicals (including pesticides) and biotic factors affecting root exudation are discussed. Studies are cited which indicate effects of pesticides on root exudation. Effects include increased amino acid exudation and cholesterol exudation with 2,4-D treatment, and increased exudation of electrolytes, amino acids and sugars following EPTC and dinoseb treatment.

81-3005. Hardin, B. (SEA, Peoria, IL) Tiny wasps—key insect in biological control. *Agric. Res.* 29(4): 11; 1981.

The possibility of using tiny parasitic wasps, *Trichogramma*, for biological control of such pests as spruce budworm is discussed. The larvae of the wasps feed on eggs of host insects. Production of the wasps is expensive; it is suggested that the development of an artificial egg mass for feeding may reduce costs. It is estimated that aerial drops of millions of these wasps would control spruce budworm in infested forests. When released 1-3 times/wk throughout the growing season, 50,000-70,000 of the parasites would be needed per application to control larval pests in a 1 acre (0.405 ha) tomato truck garden.

81-3006. Anderson, R. N. (Univ. Minnesota, Dep. Agron., St. Paul, MN 55108) Increasing soybean seeding overcomes herbicide effects. *Agric. Res.* 29(12): 15; 1981.

The detrimental effects of atrazine and metribuzin herbicides on soybean yields were reduced during a 2-yr study by increasing the soybean seeding rates. Higher yields can be obtained by increasing seeding rates in fields where problems with crop damage from atrazine or metribuzin carryover might be expected. In both years of this study, herbicides were disked into the soil in late May, and soybeans were planted the following day. The herbicide application rates were 0.5 lb acre (0.56 kg/ha), 1 lb/acre (1.12 kg/ha) and 1.5 lb/acre (1.68 kg/ha). Three seeding rates were also tested: a normal rate of 60 lb/acre (67.23 kg/ha), and higher rates of 90 lb/acre (100.85 kg/ha) and 120 lb/acre (134.46 kg/ha). In the 1978 tests, higher seedling rates improved yields. High rainfall levels for 6 wk after planting increased herbicide injury to plants. Atrazine treatment reduced plant population by about 30% compared to untreated plots. Under dry conditions, seeding rates did not affect outcome when atrazine was used at 0.5 lb/acre, but did significantly affect the outcomes when atrazine was applied at 1 lb and 1.5 lb/acre.

81-3007. Albaiges, J., ed. (Environ. Chem. Unit., Inst. Bio-Org. Chem. (CSIR), Barcelona, Spain) **Analytical Techniques in Environmental Chemistry.** (Pergamon Press: Oxford): 3: 646 pp.; 1980.

This book contains papers presented at the International Congress on Analytical Techniques in Environmental Chemistry, held in Barcelona in November, 1978. The main subject of the congress was the result of a coincidence of interests concerned with obtaining a better knowledge of the environment and increasing efforts of the chemical industries to minimize their impact on the environment. Specific pollutants considered included isoprenoid alkanes, hydrocarbons, particulate organic carbon, petroleum, polycyclic aromatic compounds, polynuclear aromatic hydrocarbons, methylchloride, polychlorinated biphenyls, chlorinated hydrocarbons, phenylurea herbicides, aminotriazole, N6-methylnitroso adenosine, styrene, and heavy metals. Abstracts of chapters from this book will appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-3008. Brassell, S. C.; Eglinton, G. (Univ. Bristol, Sch. Chem., Cantock's Close, Bristol BS8 1TS, England) **Environmental chemistry — an interdisciplinary subject. Natural and pollutant organic compounds in contemporary aquatic environments.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 1-22; 1980 (79 references).

The distribution of natural and pollutant organic compounds in the environment is reviewed. Autochthonous and allochthonous imputs are discussed; the latter include anthropogenic inputs from naturally occurring sources and from manufacture of compounds such as DDT. There are several ways in which the origin and fate of organic compounds in a given environment can be evaluated, including survey methods which can give a general picture of the organic content of a localized environment by determining the components of the organisms contributing to particular sediments; studies of the marine food web; and direct laboratory and/or field designed incubations of selected marker compounds. Several parameters are useful for relating compounds to possible sources, including stereochemical data, homologous series data, pseudohomologous series data, carbon number ranges, carbon preference index, modality of lipid distributions, and isotopic information. A fractionation study of Severn Estuary sediment is reported that demonstrated that although the hydrocarbons of 3 size fractions are qualitatively similar, they differ considerably in quantitative terms. This suggests that size fractionation shows promise as a technique for the investigation of the origins of organic compounds in sediments, especially when combined with detailed microscopic examination of each fraction.

81-3009. Frigerio, A. (Mario Negri Inst. Pharmacol. Res., I-20157 Milano, Italy) **A recent case of environmental pollution: some analytical applications.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 151-155; 1980 (5 references).

The method in which the contamination from the Seveso explosion was investigated is discussed. A method developed for routine identification and quantitative determination of TCDD is described. Following the explosion in Seveso, TCDD was found in several animal samples. Its identity was confirmed by mass spectrometry linked to high resolution glass capillary columns. Efforts were aimed at developing a method for routinely determining TCDD in tissues of different animal species. Mass fragmentography was adopted as giving the requisite specificity and sensitivity. The instrument was a gas chromatography-mass spectrometer LKB 2091, equipped with a computer system LKB 2130 for data acquisition and automatic calculation of results. Sensitivity and linearity of the GC mass fragmentographic method were tested. The minimum instrument-detectable amount was 10 pg, with a signal-to-noise ratio > 3 on the 2 focused ion. Overall recovery was 65% with the minimum detectable amount 2.5 ng/g of liver. Interfering compounds prevented the detection of TCDD in several samples.

81-3010. Liberti, A.; Brocco, D.; Di Palo, V.; Possanzini, M. (Lab. Inquinamento Atmosferico C.N.R., I-36-00131 Rome, Italy) **Evaluation of organochlorine compounds in the emissions of urban incinerators.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 157-166; 1980 (6 references).

Concentrations of organochlorine compounds were investigated in the emissions of an incinerator of a large city. The incinerator is used mainly for burning household and industrial refuse, but no chemical waste. Its organochlorine compounds emissions are strongly affected by the nature of the input material and its content of precursors as well as by operating conditions, abatement systems, and flue gas temperature. Considerable amounts of PCBs and PCDDs were found. These compounds were present in larger concentrations in the particulate matter sampled in the fumes and in the fly-ash. A variety of PCDDs were always present. The most common belonged to the more chlorinated groups; the most abundant was usually octachlorodibenzodioxin. No PCDDs were detected in the material to be incinerated, but these compounds were found in all emissions. It was concluded that reactions occur during the incineration process which form these compounds.

81-3011. Hutzinger, O.; Roof, A. A. M. (Lab. Environ. Toxicol. Chem., Univ. Amsterdam, NL-1018 WV Amsterdam, The Netherlands) **Polychlorinated biphenyls and related halogenated compounds.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 167-184; 1980 (22 references).

Halogenated chemicals that cause environmental problems are discussed. A classification scheme for organochlorine compounds, based on structural and physical properties, is presented. Environmental fate and analytical procedures for each subgroup are usually similar. The subgroups are chloroaromatics (PCB, DDT), cycloaliphatics (cyclodiene insecticides, lindane, toxaphene, mirex), saturated chloroaliphatics, unsaturated chloroaliphatics, and fluorocarbons. PCBs are presented as an example to illustrate the complexity of an environmental problem. The contribution of analytical chemistry to the understanding of such a problem is emphasized. Analysis, environmental exposure, and environmental fate are considered.

81-3012. Entwistle, A. R.; Brocklehurst, P. A.; Jones, T. G. (Natl. Veg. Res. Stn., Wellesbourne, Warwick CV35 9EF, England) The effect of iprodione on seed germination and seedling emergence in onion. *Ann. Appl. Biol.* 97(2): 175-181; 1981 (10 references).

At 100 g AI/kg, iprodione did not affect the time at which seeds began to germinate on filter paper, but there was a 7-24% reduction in final germination. There was a small but inconsistent increase in the number of abnormal seedlings. Iprodione consistently increased time to 50% of the final emergence (t_{50}) by up to 2-9 days. The effects of iprodione were independent of storage conditions, prolonged storage and low initial seed viability. Iprodione had no effect on the time at which seedlings began to emerge in compost, but consistently increased t_{50} by up to 1-5 days. The only adverse effect of iprodione occurred when compost moisture was raised to 70%, where final emergence was reduced by 9% and a 3-day delay in t_{50} was seen. These effects may have been due to poor aeration, or some iprodione may have been carried to the inside of the seed coat during rapid water uptake.

81-3013. McKinlay, R. G. (Edinburgh Sch. Agric., Edinburgh, Scotland) Insecticidal phytotoxicity and cereal grain yield. *Ann. Appl. Biol.* 97(3): 253-256; 1981 (7 references).

Seven field experiments with insecticides used for control of larvae of the wheat bulb fly were conducted in east Scotland during 1974-76 and 1977-79 to determine phytotoxic effects of the chemicals. One insecticide used in the study is chlorfenvinphos. All sites were imperfectly drained sandy clay loams, except one, which was an imperfectly drained loam. Insecticides were applied as seed coatings, soil treatment of granules, or sprays and foliar sprays. A statistical procedure, derived from the data obtained in these field experiments, measures the direct effect of the insecticides on the yield of wheat. Phytotoxicity is estimated by linear regression analysis of grain yields of undamaged shoots for all treated and untreated plots. A straight line can be drawn from the origin through the mean of data from untreated plots and from insecticide-treated plots. The slopes of the lines may be compared as a measure of the direct effect of an insecticide on wheat grain yields and wheat bulb fly control.

81-3014. Medlin, L. K. (Dep. Biol., Texas A&M Univ., Galveston, TX 77550) Effects of di-*N*-butyl phthalate and salinity on the growth of the diatom *Skeletonema costatum*. *Bull. Environ. Contam. Toxicol.* 25(1): 75-78; 1980 (7 references).

Toxicity studies were carried out in which cultures of the diatom *Skeletonema costatum* grown at 5 different salinities were exposed to various concentrations of di-*n*-butyl phthalate (DBP). To evaluate growth, relative chlorophyll *a* measurements were made, and daily cell division rates were determined based on initial and final cell counts. Although the diatoms grew in all combinations of salinity and DBP concentrations, a 2-way analysis of variance showed that the concentration of DBP, the salinity, and the interaction of these factors significantly affected the growth rate. DBP was more toxic to *Skeletonema* in media of a lower salinity; increasing salinity had a greater effect on the growth rate than DBP.

81-3015. CANUSA (Northeast. For. Exp. Stn., Broomall, PA 19008) Progress report-1980: eastern United States. *CANUSA Progr. Rep.* 1980: 33 pp.; 1981.

This report summarizes highlights of research and development progress in the area of spruce budworm control during the fiscal year of 1980. A list of publications is included. Tests of different *Bacillus thuringiensis* strains failed to identify a strain more toxic for the spruce budworm than the commercially available HD-1 strain. A bioassay system has been developed for detection of spruce budworm moth pheromone. Environmental impact of aminocarb, which has been used against spruce budworm, on aquatic organisms has been investigated. Initial data show little or no effect caused by aminocarb treatment. Carbaryl treatment, however, had severe impact on aquatic insects in Maine. Integrated pest management systems have been implemented in 6 townships in Maine, achieving a 36% reduction in acreage treated by insecticides in 1 yr.

81-3016. Grover, I. S.; Tyagi, P. S. (Dep. Biol., Guru Nanak Dev. Univ., Amritsar 143005, India) Mutagenicity of some common pesticides in barley. *Can. J. Genet. Cytol.* 22(2): 260; 1980.

Cytological aberrations and chlorophyll mutations caused by Thiodan (endosulfan), Folithion (fenitrothion), Lebaycid (fenthion) and Kitazin (IBP) in barley are described. Both mitotic and meiotic levels revealed chromosomal aberrations. Various abnormalities were noted at metaphase in treated barley grains. These ab-

normalities included fragmentation, unequal chromosome, chromosomes with displaced satellite, and increased number of chromosomes. At later stages laggards, bridges, tripolarity, tetrapolarity, and micronuclei features were noted. Dose and degree of aberration were positively correlated. Quadrivalents and univalents at metaphase-I were revealed in the meiotic analysis of MPCs from plants raised from treated barley grains. Pollen fertility was reduced. At the seedling stage, M2 analysis revealed albina, xantha, and tigrina mutants.

81-3017. Anonymous **UV rays kill toxicants.** *Chem. Mark. Rep.* 220(10): 4, 30; 1981.

A system, called the Oxyphoton Process, which destroys a wide variety of toxic organic compounds, including dioxin, DDT, and all types of halogenated aliphatic and aromatic compounds, is described. The method involves the use of concentrated UV rays and potent oxidizers. The pollutants are converted into relatively harmless compounds which can safely enter a normal biological treatment facility. The units can handle waste fluids at a rate of 60-1800 gal/hr (227-6813 l/hr).

81-3018. Anonymous **Congress urged to end conflicts in pesticide rules.** *Chem. Mark. Rep.* 220(10): 7, 61; 1981.

The dissatisfaction of some members of the chemical industry with Section 24(a) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is described. Presently, this section allows states to impose pesticide registration requirements more stringent than those imposed by the EPA. For example, California requires more information than does the EPA on 85% of all applications. The proposal presented suggests that states should assume that a federal registration is valid and not impose additional requirements, except in the case of a specific local concern. The case of California's decision to delay chemical control of the Mediterranean fruitfly is cited.

81-3019. Anonymous **Reagan team seeks to ease rules on hazardous exports: one-time notification proposed.** *Chem. Mark. Rep.* 220(11): 7; 1981.

A plan by the Reagan administration to relax the rules regarding export of hazardous products by United States companies is described. Presently, a foreign government is notified each time a hazardous shipment is to be made to that country. The new proposal suggests that in the future foreign countries will be given a one-time notification of the United States restriction or banning of a given product, but will not be given a reminder of the United States restrictions when shipment of such a product may be planned. It is reported that it cannot be documented that foreign governments have in the past taken action in response to notification concerning a United States export. Among the products that would be affected by the proposed legislation are the pesticides DDT, lindane and endrin.

81-3020. Njagi, G. D. E.; Gopalan, H. N. B. (Inst. Anim. Genet., Univ. Edinburgh, Edinburgh, Scotland) **Mutagenicity testing of herbicides, fungicides and insecticides. I. Chromosome aberrations in *Vicia faba*.** *Cytologia* 46(1-2): 169-172; 1981 (7 references).

The mitotic effects of 12 commonly used pesticides were studied in the bean plant, *Vicia faba*. The insecticides fenitrothion, methomyl, dicrotophos, endosulfan, and dicofol, the fungicides Zn + Mn carbamate and aldrin, and the herbicides propachlor, alachlor, isopropylamine, and gramoxane (paraquat) all induced acute mitostatic effects in the root meristem cells. Pycnotic nuclei and premature chromosome condensation were also observed. All effects were evident after 120 min at 10^4 ppm, and all were dose/rate dependent. Dicrotophos, dicofol, alachlor, and propachlor also induced anaphase bridges and occasional micronuclei, suggesting direct chemical action on the genetic material. Recovery experiments were not conducted.

81-3021. Vassilev, G. N. (M. Popox Inst. Plant Physiol., Bulgarian Acad. Sci., Sofia, Bulgaria) **Synthesis, herbicidal and growth-regulating activity of some thiosemicarbazides of 2,4-dichlorophenoxyacetic acid.** *Dokl. Bolg. Akad. Nauk* 34(4): 583-586; 1981 (8 references).

Germinating wheat and cucumber seeds were exposed to thiosemicarbazides of 2,4-D at concentrations of 10^{-3}-10^{-6} *M*. The herbicidal activity of the substances was determined by measuring the inhibition of the main root of the treated plants, compared with that of the water control. Herbicidal activity was usually manifested at the higher concentrations; a stimulating activity was manifested at the lower concentrations. For wheat, the highest herbicidal activity was manifested by the hydrazide, followed by the standard (diuron), and the butylthiosemicarbazide of 2,4-D. For cucumbers, the highest herbicidal activity was manifested by the hydrazide, followed by ethylthiosemicarbazide, allylthiosemicarbazide, and diuron. Regarding an indicator for selective activity, the highest activity was manifested by β-phenylethylthiosemicarbazide, hydrazide, and methylthiosemicarbazide.

81-3022. Vassilev, G. N.; Dosseva, V. N.; Terebenina, A. V.; Dimcheva, Z. P.; Borissov, G. (Inst. Gen. & Org. Chem., Bulgarian Acad. Sci., Sofia, Bulgaria) **Synthesis and biological activity of some dialkyl esters of the 2,3-dialkoxycarbonylpropanphosphonic acid.** *Dokl. Bolg. Akad. Nauk* 34(4): 587-589; 1981 (11 references).

Herbicidal and growth-regulating activities of

some alkyl esters of the phosphonium acid, 2,3-dialkoxycarbonylpropanphosphonic acid, were investigated. The phytotoxic activities were established parallel to that of diuron on germinating wheat and cucumber seeds. The highest herbicidal activity was that of diuron.

81-3023. Vassilev, G. N.; Terebenina, A. V.; Dimcheva, Z. P.; Kostova, K. V.; Jordanov, N.; Jordanov, B. I.; Kouzmanova, R. B.; Borissov, G. (M. Popoff Inst. Plant Physiol., Bulgarian Acad. Sci., Sofia, Bulgaria) **Herbicidal and growth-regulating activity of some 1-phenyl-3-methyl-5-halogenbenzoyl-oxypyrazoles.** *Dokl. Bolg. Akad. Nauk* 34(4): 591-594; 1981 (9 references).

The herbicidal activity of 1-phenyl-3-methyl- 6-halogenbenzoyl-oxypyrazoles against wheat and cucumber was tested. Diuron was used as a standard. For wheat, the order of activity was 3-Br derivative > 4-Br derivative > diuron > 2-Cl derivative. The investigated substances manifested insignificant inhibition in test cucumbers. Some of the test substances manifested stimulating activity to wheat or cucumbers at low concentrations.

81-3024. Ayazloo, M.; Bell, J. N. B.; Garsed, S. G. (Biol. Group, Fac. Sci., Tabriz Univ., Tabriz, Iran) **Modification of chronic sulphur dioxide injury to *Lolium perenne* L. by different sulphur and nitrogen nutrient treatments.** *Environ. Pollut. Ser. A* 22(4): 295-309; 1980 (28 references).

A factorial experiment is described in which the effects of SO_2 are studied in perennial ryegrass, *Lolium perenne*, at high and low levels of soil N and S. The plants were treated with nutrient solutions containing N and/or S, and exposed to SO_2 at 380 $\mu g/m^3$ or maintained in clean air (control) for 64 days. Dead leaves, living leaves, and tillers/plant were recorded at 24, 44, and 64 days; at the end of the experiment, dry wt of leaves and roots were determined, and the area of living foliage was measured. Total S and N content of the living leaves was determined, stomatal resistance measurements were made, and uptake was studied using a $^{35}SO_2$ radiotracer method. SO_2-depressed growth in all treatments. Data indicated that high N levels decreased the severity of injury, while soil S had little effect on growth. The results provide no clear explanation of the effects of nutrition on the degree of SO_2 injury.

81-3025. Greenburg, R. R. (1772 Emerson St., Palo Alto, CA 94301) **Accumulation of polychlorinated biphenyls in surficial Lake Superior sediments.** *Environ. Sci. Technol.* 14(7): 1011-1012; 1980 (13 references).

In this letter to the editor, the writer suggests that there was a computational error in an earlier article dealing with the budgeting of PCB fluxes in and out of Lake Superior. The error concerns the direction and magnitude of an estimated PCB flux. The error lies in the equation chosen to describe the transfer of PCB in the vapor phase from the atmosphere to the lake water. The equation is so stated that the flux is equal to the product of the mass transfer coefficient and the concentration of atmospheric PCB in the vapor phase. Two assumptions were made in this equation. First, that the exchange of chlorinated hydrocarbons between air and water is a gas-phase controlled, and second, that the water surface acts as a perfect absorber of these substances. The writer maintains that neither of these assumptions is correct. An author of the original article replies, providing support for the assumptions that are made, and conceding that the approach used to estimate atmospheric deposition of PCBs was simplistic. The author does not think the question raised in the letter greatly influences the conclusion of the original article.

81-3026. Chou, T. S.; Weber, D. F. (Univ. Iowa, Iowa City, IA) **The effect of atrazine on sister-chromatid exchanges in maize.** *Genetics* 97(S1): S21; 1981.

Two different concentrations of atrazine, 10 ppm and 20 ppm, were used to treat maize B37 inbred seedling roots. Sister chromatid exchanges (SEC) were detected by the fluorescence + Giemsa technique. The mean frequencies of SECs/chromosome of 10 ppm, 20 ppm atrazine treated and control plants were 0.374, 0.455, and 0.258, respectively. The frequencies in treated plants were both significantly higher than in untreated plants, confirming that mutagenic agents increase SCE frequencies. It is suggested that this may be the first example of an agent known to be plant activated showing an increase in SCEs in the plant which activates it.

81-3027. Grover, I. S.; Kaur, P. (Dep. Biol., Guru Nanak Dev. Univ., Amritsar 143005, India) **Mutagenicity of some organophosphate pesticides in barley.** *Genetics* 97(S1): S45-S46; 1981.

The mutagenicity of Rogor (dimethoate), diazinon, Dursban (chlorpyrifos) and methyl parathion was investigated by studying the induction of chromosomal aberrations and chlorophyll mutations in *M2* generations of barley. Various abnormalities were noted at metaphase in the root tip cells from barley grains treated with the chemicals, including fragments and ring chromosomes. At later stages chromatin bridges, laggards and multipolar cells were frequently encountered. The aberration frequency was dose-dependent. In the treatment with 0.75% methyl parathion, as many as 20.21% cells were aberrant. Quadrivalents were revealed at metaphase-I from pesticide treated barley grains. Chromosomal stickiness, despiralization and fragments were also noted.

81-3028. Deb-Kirtaniya, S.; Ghosh, M. R.; Adityachaudhury, N.; Chatterjee, A. (Bidhan Chandra Krishi Vishwa Vidyalaya, Kalyani, West Bengal 741235, India) **Extracts of garlic as possible source of insecticides.** *Indian J. Agric. Sci.* 50(6): 507-510; 1980 (4 references).

Extracts of garlic were obtained by various methods and subjected to different entomological screening tests for evaluating their efficacy as insecticides. For testing with lepidopteran pests, solutions of garlic extract were sprayed uniformly with a small pressure-retaining hand-compression sprayer either directly on test insects or on leaves. In the latter case, untreated insects were fed on treated leaves for 24 hr. After 24 hr, the mortality was 40% with 0.5% methanolic extract and 100% with 0.5% ethereal solution. Tests with mosquito larvae were conducted using 0.25 or 0.5% methanolic extracts of garlic and 1-day-old mosquito larvae. The larvae showed restlessness and high mortality after release into the water containing the garlic extracts, and all larvae died within 24 hr. In other experiments the extracts were effective in killing the second-instar larvae of *Euproctis* sp., a pest of *Ricinus communis*. Direct application was more effective than spraying the leaves. The fourth-instar were more tolerant to the effect of methanolic extracts than the second-instar larvae.

81-3029. Deb-Kirtaniya, S.; Ghosh, M. R.; Mitra, S. R.; Adityachaudhury, N.; Chatterjee, A. (Bidhan Chandra Krishi Vishwa Vidyalaya, Kalyani, West Bengal 741235, India) **Note on insecticidal properties of the fruits of chilli.** *Indian J. Agric. Sci.* 50(6): 510-513; 1980 (2 references).

Dried and powdered fruits of *Capsium* were extracted with petrol ether and concentrated. The thick extract was chromatographed over silica gel, and the chromatogram eluted with solvents in increasing polarity. All fractions were oily in consistency. These fractions were subjected to entomological screening tests on rice weevil, *Sitophilus oryzae* (Linn.). The insects were left in glass vials of which the inner walls had been evenly smeared with 0.4 ml of each of the fractions. All the fractions gave about 100% mortality within 72 hr after treatment. A quick knock-down effect was noted for 4 of the fractions at the low concentration of 0.25%. Mortality of > 80% was noted for the 1%, 1.25%, and 2% concentrations. Each fraction was concluded to contain insecticidally potent compounds.

81-3030. Pande, A. S.; Sarkar, R.; Krishnamoorthi, K. P. (Natl. Environ. Eng. Res. Inst., Nagpur 400020, India) **Toxicity of copper sulphate to the alga *Spirulina platensis*, and the ciliate *Tetrahymena pyriformis*.** *Indian J. Exp. Biol.* 19(5): 500-502; 1981 (9 references).

Algicidal and algistatic effects of the fungicide copper sulfate on *Spirulina platensis*, a blue-green filamentous alga, and *Tetrahymena pyriformis*, a ciliate, were studied. A stock culture was maintained at room temperature. Toxicity tests were carried out in test tubes. A stock solution of 100 mg/l Cu^{+2} was diluted with glass-distilled water to the desired concentration. The lethal concentration was determined for *Spirulina* to be at 1.3 Cu^{2+} on day 4. In a lower concentration of 0.9 mg/l Cu^{2+}, 65.6% mortality was attained. At 0.3 mg/l no mortality was observed. These findings indicate the toxicity of copper to plankton. A direct relationship was observed between toxicant concentration and % mortality in both *Spirulina platensis* and *Tetrahymena pyriformis*.

81-3031. Bristow, P. R.; Shawa, A. Y. (Washington State Univ., Pullman, WA 99163) **The influence of fungicides on pollen germination and yield of cranberry.** *J. Am. Soc. Hortic. Sci.* 106(3): 290-292; 1981 (13 references).

The impact of several fungicides on pollen germination in cranberries, and on cranberry production when applied during bloom, were studied. In *in vitro* tests, captan, captafol, and mancozeb at 10 μg, and cupric hydroxide, ferbam, triforine-EC, and zineb at 100 μg AI/ml glucose amended cornmeal agar, completely inhibited pollen germination; triforine-F and triforine-WP at 10,000 μg/ml allowed some pollen germination. In order to test the same concentrations *in vivo*, suspensions were applied directly to the stigma of detached flowers prior to hand pollination. Treatment with 10,000 μg/ml of captafol, cupric hydroxide, ferbam, and triforine-EC completely inhibited germination, while the other compounds and concentrations tested had little effect. In field tests in which the fungicides were applied twice during bloom, only triforine-EC at 0.33 kg AI/ha significantly reduced yield (by 41%). This compound did not alter the number of berries/upright, but resulted in the production of fewer and lighter berries. This study confirms other results, which indicate that the toxicity of fungicides determined by *in vitro* techniques does not necessarily correlate with that from *in vivo* methods.

81-3032. DePablo, R. S. (Diamond Shamrock Corp., Painesville, OH 44077) **Vapor pressure of dimethyl tetrachloroterephthalate.** *J. Chem. Eng. Data* 26(3): 237-239; 1981 (5 references).

The application of pesticides in agriculture and their potential action in humans make it necessary to known their absolute volatilities and vapor pressures. A combined knowledge of the vapor pressure and the biological action of a pesticide will provide a clear picture of the use hazards. The vapor pressures of dimethyl tetrachloroterephthalate (Dacthal; DCPA) have been determined at 75-160°C. Measured vapor pressures were in the range 0.0007-1.478 torr. Experimental conditions studied included effusion hole diameter and effusion time. The compound has no phase change below its melting point of

~ 160°C. Effusion procedures and gas saturation method were used. The average molar vaporization heat is calculated to be ~ 25 kcal/mol in the measured temperature interval. The Clausius-Clapeyron equation was followed in this temperature range. For each temperature and for each hole diameter, a minimum effusion time was required. The effusion method seems to be more precise than the gas saturation method using the 916-TEA.

81-3033. Molloy, D.; Jamnback, H. (Sci. Serv., NY State Mus., State Educ. Dep., Albany, NY 12230) **Field evaluation of *Bacillus thuringiensis* var. *israelensis* as a black fly biocontrol agent and its effect on nontarget stream insects.** *J. Econ. Entomol.* 74(3): 314-318; 1981 (12 references).

When a small stream was treated at 0.5 ppm/15 min (13°C) with an aqueous suspension of unformulated Bellon primary powder of *Bacillus thuringiensis* Berliner var. *israelensis*, 96, 86, 53, and 11% reduction occurred, respectively, in larval populations of *Simulium* spp. black flies at 20, 180, 350, and 705 m below the treatment point. In contrast, the number of black fly larvae declined by only 5% in the upstream control. Mortality occurred within 2-3 days of treatment, with few dead larvae remaining attached by the 5th day posttreatment. The mortality rates of larvae transported to and reared in the laboratory for 48 h post-treatment closely corresponded to the rates recorded in the stream. Significantly higher mortality rates occurred among smaller larvae. In contrast to the sharp reduction (89%) in black fly larvae in the 20-350 m area below the treatment point, Surber samples indicated increases in mayfly (35%), caddisfly (47%), stonefly (75%), chironomid (19%), and elmid (242%) populations. Thus, no adverse effect on any of these nontarget populations was evident following stream treatment. (Abstract by permission of the American Chemical Society)

81-3034. Moscardi, F.; Allen, G. E.; Greene, G. L. (CNP Soja/EMBRAPA, 86100 Londrina, Parana, Brazil) **Control of the velvetbean caterpillar by nuclear polyhedrosis virus and insecticides and impact of treatments on the natural incidence of the entomopathogenic fungus *Nomuraea rileyi*.** *J. Econ. Entomol.* 74(4): 480-485; 1981 (32 references).

Different concentrations of nuclear polyhedrosis virus (NPV) and insecticides (carbaryl and methomyl) were applied to natural infestations of the velvetbean caterpillar (VBC), *Anticarsia gemmatalis* Hueber, on soybean. Their efficacy in reducing VBC larval populations and their effect on naturally occurring epizootics of the entomogenous fungus *Nomuraea rileyi* (Farlow) Samson were determined. Persistence of the virus in the field was measured. Virus application rates of 75, 145, and 287.5 larval equivalents (LE)/ha suppressed VBC populations below damaging levels. Most virus-induced mortality occurred at 6, 7, and 8 days after spraying. The virus retained 65 to 70% of its original pathogenicity 7 days after treatment and 25 to 35% at 10 days. All virus doses greatly reduced the magnitude of a *N. rileyi* epizootic. Carbaryl or methomyl applied once at 0.28 or 0.07 kg AI/ha effectively suppressed VBC populations below economic levels for the remainder of the season. High concentrations of insecticides reduced the impact of *N. rileyi* by reducing the natural substrate, VBC larvae. (Author abstract by permission)

81-3035. Braden, J. B.; Bromley, D. W. (Dep. Agric. Econ., Univ. Illinois Urbana-Champaign, Urbana, IL 61801) **The economics of cooperation over collective bads.** *J. Environ. Econ. Manage.* 8(2): 134-150; 1981 (29 references).

Pollution is analyzed graphically as a collective bad traded among reciprocating nations. The three defining features of a collective bad are that it is "non-optional, non-excludable, and jointly supplied." A theory is proposed that adapts concepts of trade in public goods to exchanges of collective bads. Several cooperative arrangements are suggested to modify the effects of exchanged harms resulting from the spread of toxic chemicals (including pesticides) in the environment. It is concluded that joint actions involving efforts greater than the sum of those actions undertaken independently can produce superior results. Cooperative arrangements, involving many distributions of welfare gains among parties, may be feasible. The ultimate choice among these arrangements depends on judgements about the relative merits to the involved parties or on their bargaining abilities. Tax policies are useful devices for studying cooperative arrangements, though a host of obstacles may block the use of taxes or charges. It is suggested that rather than confine the discussion to narrowly conceived policies and solutions, efforts to promote cooperation over exchanged pollutions are more likely to be fruitful if aims are set reasonably.

81-3036. Reish, D. J.; Geesey, G. G.; Oshida, P. S.; Wilkes, F. G.; Mearns, A. J.; Rossi, S. S.; Ginn, T. C. (California State Univ., Long Beach, CA) **Marine and estuarine pollution.** *J. Water Pollut. Control Fed.* 53(6): 925-949; 1981 (351 references).

Recent advances in the study of marine and estuarine pesticide pollution are reviewed. Advances in methodology include a marine algal bioassay method suitable for conducting short- and long-term studies on pesticides, a positive pressure proportional diluter for estuarine organism studies, and simple methods for extraction and clean-up of fish and fish product samples. Studies of acute effects in aquatic organisms were reported for mixtures of phosphamidon and methidathion, diazinon, diflubenzuron, and Kepone (chlordecone). Studies of the sublethal effects of carbaryl, parathion, DDT, malathion,

Kepone, surflo, and aldacide are reviewed. Studies on metabolism of DDT, methyl parathion, methyl paraoxon, and the DDT analogue, EDO, are reported. The stability of toxaphene, atrazine, Kepone, and parathion in estuarine sediments was studied. Bioaccumulation studies have been conducted with fenitrothion, endrin, and mirex. A table summarizes pesticide residue data reported in the literature.

81-3037. Hardell, L.; Eriksson, M. (Dep. Oncol., Univ. Hosp., S-90185 Umea, Sweden) **Soft-tissue sarcomas, phenoxy herbicides, and chlorinated phenols.** *Lancet* 2(8240): 250; 1981 (7 references).

In this letter to the editor epidemiological studies of soft-tissue sarcomas, phenoxy herbicides, and chlorinated phenols are presented. Of 105 deaths among industry employees exposed to 2,4,5-T, 3 were due to soft-tissue sarcoma, which is significantly above the 0.07 expected. Among Swedish lumberjacks exposed to phenoxy herbicides, 7 cases of soft-tissue sarcoma were noted. Two case control studies were also conducted which demonstrated an increased risk for those with occupational exposure to phenoxy herbicides or chlorophenols among cases of soft-tissue sarcoma. It is concluded that a connection between exposure to phenoxy herbicides and the occurrence of soft-tissue sarcoma may exist.

81-3038. Reeves, J. D.; Driggers, D. A.; Kiley, V. A. (Dep. Pediatr., David Grant Med. Cent., Travis Air Force Base, CA 94535) **Household insecticide associated aplastic anaemia and acute leukemia in children.** *Lancet* 2(8241): 300-301; 1981 (13 references).

In this letter to the editor marrow failure in children shortly after exposure to DDVP (dichlorvos), propoxur, or malathion is described. Blood counts were previously normal in all of 7 cases reported. Following exposure all patients had pancytopenia with varying clinical courses. The patients had not been exposed to chloramphenicol, other chemotherapeutic agents, organochlorine pesticides, benzene, gamma rays, or other known hematotoxins. Although this study does not offer proof that the pesticides led to the diseases, it does suggest that the compounds may, on rare occasions, be highly hematologically toxic.

81-3039. Crow, K. D. (Princess Margaret Hosp., Swindon SN1 4JU, England) **Soft tissues sarcomas and chlorinated phenols.** *Lancet* 2(8242): 369; 1981 (3 references).

A letter to the editor is presented in which it is suggested that some studies regarding soft tissue malignancies following exposure to 2,4,5-T have been unsatisfactory. In 1 instance lengths of exposure are not specified. One set of experiments on rats showed soft tissue malignancies, but other studies showed epithelial malignancies only in rats and mice receiving hexachloro (HCDD) and tetrachloro (TCDD) dioxin daily throughout their lifetime.

81-3040. Bishop, C. M.; Jones, A. H. (Employment Med. Advisory Serv., Brunel House, Cardiff CF2 1SH, Wales) **Non-Hodgkin's lymphoma of the scalp in workers exposed to dioxins.** *Lancet* 2(8242): 369; 1981.

In this letter to the editor a brief case history of 2 pesticide production workers exposed to TCDD is presented. Patient A worked in a production plant from 1959 to 1972. He developed a non-Hodgkin's lymphoma on the scalp in 1976, and showed mild chloracne on the face and trunk. Patient B worked at the same plant from 1957 to 1978. He had severe chloracne over much of his body and developed a non-Hodgkin's lymphoma of the scalp. The number of neoplasms of this type (ICD 200 and 202) expected in this group of 158 workers is 0.28.

81-3041. Mitchell, E. R., ed. (USDA, Gainesville, FL) **Management of Insect Pests with Semiochemicals. Concepts and Practice.** (Plenum Press: NY): 514 pp.; 1981.

This book contains the proceedings of an international symposium presented jointly by the Insect Attractants, Behavior, and Basic Biology Research Laboratory, USDA, and the Department of Entomology and Nematology, University of Florida, held in March of 1980 in Gainesville, Florida. The sessions of the conference dealt with biomonitoring; mass trapping; mating disruption; formulation, toxicology, and registration; and oviposition disruptants and antiaggregants. Semiochemicals considered included pheromones, kairomones, oviposition deterrents, and other behavior-modifying chemicals. Abstracts of chapters from this book will appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-3042. Cunningham, R. T. (Trop. Fruit & Veg. Res., Lab., Agric. Res., SEA USDA, Honolulu, HI 96804) **The 3-body problem analogy in mass-trapping programs.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 95-102; 1981 (12 references).

The patterns of attractant allocation in space and time for mass-trapping insect control programs are reviewed. A large-scale test is described in which 5 cm^2 fiberboard blocks treated with naled were hung from the trees at regular intervals in a macadamia orchard to control melon fly. Each block had 25 g of 5% naled solution in cue-lure. As trap density increased, populations of melon fly decreased. The proportion of the population of males killed was a hyperbolic function of the number of blocks/ha. Beyond a certain point, increasing density becomes

uneconomical. A simple model is also described of the interaction of 2 variables in such undertakings. The 3-dimensional model generates a smoothly curving response surface, in demonstrating the influence of amount of lure/trap on the proportion of insects caught with changing time. The example uses methyl eugenol for the oriental fruit fly.

81-3043. Bedard, W. D.; Wood, D. L. (Pac. Southwest For. & Range Exp. Stn., Forest Serv., USDA, Berkeley, CA 94701) **Suppression of *Dendroctonus brevicomis* by using a mass-trapping tactic.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 103-114; 1981 (33 references).

Research on the development of a mass-trapping suppression tactic for a bark beetle species is reviewed. Progress made to date is outlined and work needed in the future is suggested. For mass-trapping to be effective it must be used with a potent synthetic attractant that mimics the characteristics of the natural attractant. Chemical characterization of the actual attractant is a necessary part of initial research. In many cases, single compounds and binary mixtures have been found to be either unattractive or very weakly attractive. More than one compound is usually involved. Once a potent synthetic attractant that can be produced in large quantities has been developed, a trapping system that will attract and catch beetles at the attractant source must be designed. The trap, attractant release rate, and response of natural enemies and other nontarget organisms must all be determined. Efficacy, safety, and cost factors must be considered. Trapping mechanisms must also be be considered in light of the total forest management plan.

81-3044. Lanier, G. N. (SUNY Coll. Environ. Sci. & For., Syracuse, NY 13210) **Pheromone-baited traps and trap trees in the integrated management of bark beetles in urban areas.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 115-131; 1981 (28 references).

Field trial results from mass-trapping of *Scolytus multistriatus*, principal vector for Dutch elm disease (DED), using multilure-baited sticky traps containing elm bark beetle aggregation pheromone, are discussed. These studies have shown varying degrees of success. Mass-trapping near intensively managed elm groves has consistently reduced DED. In one study contrasting physical situations and different numbers of traps/elm tree were compared in their effects on DED disease incidence. In an area where there was one trap/amenity elm, little possibility for root graft, and moderate pressure from immigrating elm bark beetles, DED rates plummeted. In another area where elms were densely spaced (13/trap), and adjacent to areas containing abundant elms and broad wood, DED increased in spite of catching 20-30,000 beetles/trap. More favorable results were always obtained in areas relatively free from broad wood and newly infested material that acted as competing pheromone sources. Application of the trap/tree technique is discussed.

81-3045. Borden, J. H.; McLean, J. A. (Pestology Cent., Dep. Biol. Sci., Simon Fraser Univ., Burnby, British Columbia V5A 1S6, Canada) **Pheromone-based suppression of ambrosia beetles in industrial timber processing areas.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 133-154; 1981 (62 references).

Isolation and synthesis of ambrosia beetle aggregation pheromones are reported, and studies of pheromone suppression of ambrosia beetles in areas of industrial timber production are reviewed. Three species-specific aggregation pheromones were isolated. Each is chiral in nature and the response by beetles in the field is influenced by the chirality of the pheromone deployed. Critical problems arise when the prospect of combining compatible pheromones and synergists is considered, and additional research is needed to find a type of trap which is effective with synergized pheromones for both *Trypodendron* and *Gnathotrichus* spp. and to standardize pheromone- and synergist-release rates for use in that trap. Aerial applications of chlorinated hydrocarbon insecticides has been routinely and effectively used in the past to protect water-stored logs from ambrosia beetle attack. However, environmental contamination with insecticides became a problem. Repellents based on tree extractives can protect logs from attack, but these are still in the basic research phase. Logistics of a pheromone-based management operation are critical to its success. Operations against *Gnathotrichus sulcatus* in sawmills is discussed.

81-3046. Peacock, J. W.; Cuthbert, R. A.; Lanier, G. N. (USDA For. Serv., Delaware, OH 43015) **Deployment of traps in a barrier strategy to reduce populations of the European elm bark beetle, and the incidence of Dutch elm disease.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 155-174; 1981 (19 references).

Research on the aggregation on the pheromone of the European elm bark beetle (*Scolytus multistriatus*), principal vector for Dutch elm disease (DED), is reviewed. Studies to determine the efficacy of a pheromone-trapping system to control elm bark beetle populations and reduce DED incidence are reviewed. The effectiveness of this method in reducing the incidence of DED has been variable. Successful use of the trapping has been achieved in small groves or scattered stands of elms. However, application of the existing multilure-trapping system for reducing DED in large-area, city-wide trapping efforts has been unsuccessful or results inconclusive, in spite of the an-

nihilation of millions of beetles each year in these city-wide programs. One possible explanation for the discrepancy in results from grove *vs.* city-wide studies is that elms in the groves or scattered stands are free of diseased elm wood and beetles, and thus are free of sources of attractant that will compete with the traps. Refinements are being investigated in trap deployment strategy, as well as in the chemical makeup and formulation of the lure. More intensive study of beetle behavior is needed.

81-3047. Lie, R.; Bakke, A. (Borregaarad Ind., Ltd., N-1701 Sarpsborg, Norway) **Practical results from the mass trapping of *Ips typographus* in Scandinavia.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 175-181; 1981 (15 references).

Drought and recent changes in logging and transportation methods as well as other factors have caused an increase in the population of *Ips typographus* (L.) in Scandinavia. Field experiments were conducted that demonstrated that boring males of *I. typographus* produced pheromones that attract both male and female beetles. The components were identified; both sexes respond to a mixture of methylbutenol, *cis*-verbenol, and ipsdienol. This mixture was used in traps to control the population growth of *I. typographus*. The large-scale use of pheromones requires a practical dispenser system which must provide continuous release of the pheromone over the prescribed period while also being able to withstand the forest environment. Traps which have been used were composed of cardboard cylinders, sticky paper, fiberglass screen vanes, perforated PVC cylinders and others. To evaluate their efficiency the Norwegian Forest Research Institute randomly selected about 6000 traps and dispersed them throughout the entire trapping program area. Trap location and beetle density caused trap catches to vary considerably. The average catch per trap was 4850 beetles, while the total catch was about 2.9 billion. More than 99% of the catch was the target insect.

81-3048. Klein, M. G. (Japanese Beetle & Hortic. Insect Pests Res. Lab., Agric. Res., SEA, USDA, Wooster, OH 44691) **Mass trapping for suppression of Japanese beetles.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 183-190; 1981 (22 references).

Research on isolation of beetle attractants that might be used to control the Japanese beetle is reviewed. Mass trapping at Nantucket, MA in 1971 reduced beetles by at least 50% over the following 3 yr. The pheromone Japonilure was finally produced and formulated for use against the beetle. A dual-lure system was then developed using phenethyl propionate (PEP):eugenol and virgin female beetles. Female captures using the chemical lure + females were almost twice as great as female capture using PEP:eugenol alone. Japonilure and PEP:eugenol were then combined during the adult flight season. Traps placed in the sunshine were twice as effective as those in the shade; maximum captures occurred between 10:00 AM and 1:00 PM. Three commercially available traps are briefly noted.

81-3049. Lloyd, E. P.; McKibben, G. H.; Witz, J. A.; Hartstack, A. W.; Lockwood, D. F.; Knipling, E. F.; Leggett, J. E. (Boll Weevil Erad. Res. Lab., Agric. Res., SEA, USDA, Raleigh, NC 27607) **Mass trapping for detection, suppression and integration with other suppression measures against the boll weevil.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 191-203; 1981 (11 references).

To study the influence of trap density and spacing on probability of detecting and controlling small, isolated populations of boll weevils, modified Mitchell traps were placed in cotton fields about 1 wk prior to installing infested squares. The traps were baited initially and weekly thereafter with 3 mg of Grandlure impregnated in polyester-wrapped cigarette dispensers. The squares were infested so that emergence from them would occur uniformly over a 10-day period. The emergence area was about 33 m long. The emergence rate averaged about 75% of that expected. On the basis of sex distribution, emerging females averaged 8 and 4/field plot at the 2 density levels tested. The spatial arrangements of traps 210, 149, 121, and 105 ft (64, 45, 37, and 32 m) apart represent slightly more than 1, 2, 3, and 4 traps/0.4 ha, respectively for large cotton fields. By the time emergence of ~ 8 males and 8 females in each field was complete, the traps were more competitive than the males in capturing females. Data suggests that high density trapping may be highly effective for the suppression and management of low level boll weevil populations. The area of influence of traps was assumed to be 0.4 ha. Possible use of Grandlure for boll weevil management is discussed.

81-3050. Lloyd, E. P.; Bedard, W. D.; Borden, J. H.; Cunningham, R. T.; Huber, R. T.; Lanier, G. N.; Lie, R.; Klein, M.; Peacock, J. W. (Boll Weevil Erad. Res. Lab., Agric. Res., SEA, USDA, Raleigh, NC 27607) **Future thrusts for developing and utilizing mass-trapping technology.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 205-206; 1981.

The potential role of mass-trapping technology in the suppression of populations of insects which damage forests, forest products, shade trees, ornamentals, and cultivated crops is very great. Judicious selection of appropriate pests and commodities that are amenable to the mass-trapping strategy is essential. Techniques for measuring the impact of mass trapping on the population and the determination of injury at various population levels must

be developed. These techniques will identify the potential biological, economic, and environmental benefits that will accrue from the employment of these mass trapping methods. Technology transfer is an important step in bringing these programs to fruition. Technology must be transferred from the scientist to the potential user.

81-3051. Rothschild, G. H. L. (Div. Entomol., CSIRO, Canberra, Australia) **Mating disruption of lepidopterous pests: current status and future prospects.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 207-228; 1981 (57 references).

Possible mechanisms involved in the mating disruption caused by synthetic sex pheromones or other behavior modifiers when used against lepidopterous pests are cited. Most disruption trials have involved liberation of behavior-modifying chemicals from various dispensing systems into a well-defined area for various periods of time, and use of criteria for assessing the effect of this treatment, compared with an untreated plot. A total of 170 field trials were reviewed for this article, with about 25% of them extending over a full field-season with the objective of determining whether the treatments were effective in decreasing crop infestation. Data are presented for control of the spruce budworm, *Choristoneura fumiferana;* the Oriental fruit moth, *Cydia molesta; Spodeoptera litura; S. littoralis; Diparopis castanea; Ephestia cautella; Adoxophyes orana; Chilo suppressalis;* and *Heliothis* species. The aerial distribution and concentration of behavior-modifying chemicals were obviously a key factor in determining the outcome of the individual experiments. Immigration was seen as 1 example of possible problems in evaluating mating disruption experiments. Other problems include inadequate release and uneven distribution of chemicals, attraction of nontarget species, high adult densities in the population, and reduction in fertile eggs caused by some factor other than the experiment under study.

81-3052. Roelofs, W. L.; Novak, M. A. (Dep. Entomol., N.Y. State Agric. Exp. Stn., Geneva, NY 14456) **Small-plot disorientation tests for screening potential mating disruptants.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 229-242; 1981 (11 references).

A standard format for small-plot tests was used to compare possible disruptant materials in screening for potential mating disruptant chemicals. The small-plot tests do not test for mating disruption, but indicate chemicals, blends, and concentrations that are effective at the first-level of testing. Materials during 95% disorientation or better from these tests are considered for further testing. All 25 × 30 m plots to be used are marked and monitored with a pheromone trap prior to the test; pairs of plots are determined according to similar trap catch; treatments are randomly distributed to 1 plot of each pair; trap catch data from the treated plot and check plot are subjected to an analysis of covariance to determine significant differences among treatments. At this level of testing the redbanded and obliquebanded leafrollers react differently to the various disruptants, even though their pheromone blends were similar. The redbanded leafroller moth was easily disoriented by the main pheromone component, whereas the obliquebanded leafroller moth was disoriented only by the 90:5:5 natural blend of pheromone components.

81-3053. McLaughlin, J. R.; Mitchell, E. R.; Cross, J. H. (Insect Attractants Behavior & Basic Biol. Res. Lab., AR-SEA, USDA, Gainesville, FL 32604) **Field and laboratory evaluation of mating disruptants of *Heliothis zea* and *Spodoptera frugiperda* in Florida.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 243-251; 1981 (18 references).

The effectiveness of the air permeation technique for disrupting pheromone mating communication was evaluated as a means of controlling the corn earworm in Florida. In August 1979 a test was conducted to evaluate Hercon flake formulations of potential corn earworm disruptants dispensed by aircraft. The materials were applied at a rate of 12.3 g AI/ha to 0.81 ha plots of commercial sweet corn arranged in a randomized complete block design with 4 blocks. Treated plots were separated by at least 137 m. The disruptant chemicals were (*Z*)-9-tetradecenyl-1-ol formate (Z9:14F), (*Z*)-11-hexadecanal (Z11:16Al), a 1:1 mixture of Z11:16Al and Z9:16Al, and a 16:1 mixture of Z11:16Al and Virelure (Z9:14Al). A cone trap at the center of 2 plots of each treatment was baited with 3 virgin female corn earworms; the traps in the other 2 plots were baited with synthetic corn earworm sex pheromone. The results with both types of trap bait were statistically identical. Despite the wide separation of plots, there was a good deal of overspray into control areas.

81-3054. Campion, D. G.; McVeigh, L. J.; Hunter-Jones, P.; Hall, D. R.; Nesbitt, B. F.; Marrs, G. J.; Alder, M. R. (Cent. Overseas Pest Res., Coll. House, London W8 5SJ, England) **Evaluation of microencapsulated formulations of pheromone components of the Egyptian cotton leafworm in Crete.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 253-265; 1981 (8 references).

Laboratory and field tests were performed to compare several gelatin-and polyurea/polyamide- base microencapsulated formulations of (*Z*)-9-tetradecenyl acetate (IIA). Treatment areas consisted of lucerne fields sited mainly along the north coast of Crete. For initial experiments, 1 to 4 standard water traps baited with polythene vials containing 1 mg (*Z,E*)-9,11-tetradecadienyl

acetate (III) were located in each plot, the number used depending on plot size. Low levels of disruption were achieved for both the polyurea/polyamide and gelatin microcapsules containing IIA. Relatively high rates of disruption were achieved with polyurea-based microcapsules containing III. Persistence of disruption under shielded and exposed conditions was measured biologically.

81-3055. Henneberry, T. J.; Bariola, L. A.; Flint, H. M.; Lingren, P. D.; Gillespie, J. M.; Kydonieus, A. F. (West. Cotton Res. Lab., Agric. Res., SEA, USDA, Phoenix, AZ 85040) **Pink bollworm and tobacco budworm mating disruption studies on cotton.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 267-283; 1981 (36 references).

The effect of combinations of Gossyplure, Virelure, 1-tetradecenal formate (TF), and (*Z*)-9-tetradecen- 1-ol formate (*Z*-9-TDF) in polymeric membrane formations for controlling pink bollworm and tobacco budworm in cotton was evaluated. Studies were conducted in 17 cotton fields in the southwestern United States. Results were monitored with pheromone traps, by picking cotton bolls, by operating flight traps, by egg and larval counts on terminals, and by nocturnal collections. Amounts applied on a given date ranged from 3.5 to 4.9 g/ha for Gossyplure, 12.4 to 30.1 g/ha for TF, 7.4 to 14.8 g/ha for Virelure, and 8.7 to 19.8 g/ha for *Z*-9-TDF. Effects of Gossyplure + TF, Virelure, or *Z*-9-TDF on catches of male moths in Gossyplure-baited traps were similar. Catches were low until mid-July, when an average of 93% captures were noted in treated fields through September 11. Nocturnal collections were also investigated.

81-3056. Doane, C. C.; Brooks, T. W. (Controlled Release Div., Albany Int., Buckeye, AZ 85326) **Research and development of pheromones for insect control with emphasis on the pink bollworm.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 285-303; 1981 (14 references).

The development of the hollow fiber control system for pheromone mating disruption of pink bollworm is discussed. Demonstration studies performed in Bolivia, Colombia, India, Argentina, Brazil, and Mexico are discussed. To data, about 50,000 ha of cotton have been treated with the hollow fiber system for control of the pink bollworm. Demonstration and commercial programs have been successful under a wide range of environmental conditions, ranging from hot, arid desert to tropical, humid jungle and to high, cool mountain valleys. The system has proved to be highly dependable and is one that integrates well with a wide range of pest control programs and variations in farming practices. The degree of acceptance of this new technology has been high among cotton farming groups and governments of the countries in which large-scale demonstrations have been conducted.

81-3057. Beevor, P. S.; Dyck, V. A.; Arida, G. S. (Trop. Prod. Inst., London WCIX 8LU, England) **Formate pheromone mimics as mating disruptants of the striped rice borer moth, *Chilo suppressalis* (Walker).** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 305-311; 1981 (5 references).

Field cage experiments were conducted to determine the effects of low concentrations of (*Z*)-9-tetradecenyl formate (TDF) and (*Z*)-11-hexadecenyl formate (HDF) pheromone mimics on mating disruption of *Chilo suppressalis* in 16-m_2 field cages 2 m high. A rice variety highly susceptible to stem borer attack was transplanted to an experimental farm. Thirty days after transplant and before natural infestation by *C. suppressalis*, cages consisting of a wooden frame covered by nylon mesh were constructed within the rice paddy to maintain a nearly normal crop grown in isolation from immigrant moths. TDF and HDF were dispensed from polyethylene vials in a ratio of 4.5:1 at total loadings of 0.1, 0.5, and 1.0 mg/vial and containing equal amounts of 2,6-di-*t*-butyl-*p*-cresol as antioxidant. Each cage received 40 pairs of moths during the 30-day experiment. Each cage was searched for egg masses on alternate days. A marked correlation of TDF and HDF rates of loss between 0.25 and 1.10 g/ha/day and mating disruption between 90 and 100% was found. These experiments demonstrate the feasibility of disruption of mating in *C. suppressalis* using the formates TDF and HDF, compounds structurally related to but more stable than the natural pheromone components.

81-3058. Tatsuki, S.; Kanno, H. (Lab. Insect Physiol. & Toxicol., Inst. Phys. & Chem. Res., Wako, Saitama 351, Japan) **Disruption of sex pheromone communication in *Chilo suppressalis* pheromone and analogs.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 313-325; 1981 (10 references).

The disruptive effect of (*Z*)-5-hexadecane (*Z*-5-HD) and other pheromone-related compounds on sex pheromone communication of *Chilo suppressalis* is discussed along with the possible mechanism of this disruption. The disruptive activity was demonstrated by several behavioral experiments conducted both in the field and in the laboratory. EAG experiments supported the field data with quantitative aspects of activity. Laboratory and EAG studies showed that sensory adaption may be the mechanism of disruption. Before *Z*-5-HD can be used to control this pest, its effectiveness in large populations of *C. suppressalis* must be evaluated. Comparative studies on the effectiveness of *Z*-5-HD alone and in mixtures with (*Z*)-5-octadecone (*Z*-5-OD) and of the hydrocarbons and

the formates are needed. What effects Z-5-HD and other hydrocarbons might have on the sex pheromone communication of other species that use aldehyde pheromones should also be determined.

81-3059. Arn, H.; Rauscher, S.; Schmid, A.; Jaccard, C.; Bierl-Leonhardt, B. A. (Swiss Fed. Res. Stn. for Hortic. & Vitic., CH-8820 Wadenswil, Switzerland) **Field experiments to develop control of the grape moth, *Eupoecilia ambiguella*, by communication disruption.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 327-338; 1981 (16 references).

Preliminary experiments indicated that a number of chemicals related to the *Eupoecilia ambiguella* pheromone could be used to disrupt male orientation, but the most effective one appeared to be (*Z*)-9-dodecenyl acetate. A field experiment was carried out in a vineyard near Lake Geneva where a sizable population of *E. ambiguella* and virtually no *Lobesia botrana* were found. Eighty-six trap stations were placed in a 25 × 25 m grid inside and outside the 1.5 ha plot to be treated. Each trap station consisted of a pheromone trap and a bait trap. On May 6, 4000 pheromone dispensers were deployed with release rates of 5.6 μg/ha/dispenser at 32°C and 100 mg air/min. Mating of the grape moths was significantly reduced due to the disruption technique. Test results indicate that the method could be used where populations are not too high. Apparent matings that occurred in the treated area were attributed to release of insufficient quantities of disruptant or to the migration of gravid females into the treated area. Results of first field tests with a rope formulation are also reported.

81-3060. Sanders, C. J. (Can. For. Serv., Great Lakes For. Res. Cent., Sault Ste. Marie, Ontario, Canada) **Disruption of spruce budworm mating – state of the art.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 339-349; 1981 (15 references).

Approaches to the study of spruce budworm control by mating disruption are reviewed. Some unresolved problems in such studies are discussed. The nature of disruption is not fully understood, especially the role of chemicals in mating behavior. Three stages in the mating sequence have been identified: location of the female, recognition of the female, and courtship leading to copulation. Most disruption experiments seek to prevent location of the female by the pheromone odor plume. The role of chemicals in recognition of the female and in courtship behavior is not known. Current knowledge about spruce budworm mate-locating behavior is summarized. Inhibitors (suboptimal blends of isomers of female pheromone) have an effect only when they are dispersed from the same trap as the attractant and not when they are released from dispensers a few meters from the trap, suggesting that the coincidence of superpositioning of the odor plumes of the 2 chemicals is important. Appropriate formulations and careful selection of test sites are important factors in testing the effectiveness of synthetic attractants.

81-3061. Sower, L. L.; Daterman, G. E.; Sartwell, C. (Pac. Northwest For. & Range Exp. Stn., For. Serv., USDA, Corvallis, OR 97331) **Control of moth pests by mating disruption in forests of the western United States.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 351-364; 1981 (24 references).

Damage by western pine shoot borer was controlled by mating disruption with a synthetic pheromone that appears to be economically feasible to produce. Larger-scale applications for control are planned, and registration appears likely in the future. Disruption was highly to moderately effective in reducing Douglars-fir tussock moth reproduction. Further tests that stress the impact of the pheromone on tree damage and population levels are needed. Test results with western spruce budworm have not been published. No safety problems or significant adverse environmental impacts associated with pheromone disruption of forest Lepidoptera have been noted.

81-3062. Payne, T. L. (Dep. Entomol., Tex. Agric. Exp. Stn., Tex. A&M Univ., College Station, TX 77843) **Disruption of southern pine beetle infestations with attractants and inhibitors.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 365-383; 1981 (28 references).

Studies of the effects of the attractant mixture frontalure on southern pine beetle infestations are reviewed. Field tests were conducted in 2 active infestations of 75 loblolly pines in Montgomery County, TX. Frontalure was eluted from polyethylene caps, each containing 200 μl of the attractant. Each cap released about 18 mg frontalure/day at temperatures of 27-35°C, based on gravimetric analysis. Four caps were spaced equidistant from one another at 3 m on selected host and non-host trees within each infestation. Not one previously uninfested tree came under successful mass attack during the frontalure treatment periods. The placement of frontalure within the infestation interrupted the spot growth phenomenon of beetle activity. In subsequent studies, frontalure was used to contain emerging broods in the areas of infestation that were not conducive to population growth. Tests of inhibitors are also reported.

81-3063. Carde, R. T. (Dep. Entomol., Michigan State Univ., East Lansing, MI 48824) **Disruption of long-distance pheromone communication in the oriental fruit**

moth: camouflaging the natural aerial trials from females. In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 385-398; 1981 (37 references).

A combination of (*Z*)-8-dodecenyl acetate and (*E*)-8-dodecenyl acetate or a blend of these acetates plus (*Z*)-8-dodecen-1-ol are effective in disrupting long-range pheromone communication in the oriental fruit moth, *Grapholitha molesta.* The 3-component blend appears to be efficacious at lower concentrations than the 2-acetate mixture and thus would have the most potential for direct population manipulation. Three principal hypotheses for the mechanism of communication disruption are presented and discussed. For *G. molesta,* a camouflaging mechanism is proposed, in which natural aerial trials are camouflaged by raising the concentration of synthetic pheromone above the density of pheromone emanating from the female, making the boundaries of the natural plume indiscernable. The possible development of resistance over a period of time is considered.

81-3064. Rothschild, G. H. L.; McLaughlin, J.; Campion, D. G.; Henneberry, T.; Doane, C. C.; Beevor, P. S.; Tatsuki, S.; Roelofs, W. L.; Carde, R. T. (Div. Entomol., C.S.I.R.O., Canberra, A.C.T. 2602, Australia) **Future thrusts on mating disruption of pest insects with semiochemicals.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 399-401; 1981.

Problems in the progress of pest control by mating disruption are discussed. A major obstacle has been the development of suitable formulations and application systems. Continued study of new slow-release technology is needed to meet the specific needs of mating disruption projects. The ideal application system would use existing agricultural equipment. Collaboration is needed between appropriate government agencies and industry. Identification of sex pheromones should continue on a rational basis, with emphasis on the full identification of pheromone blends of important species. Ecological and behavioral characteristics of the target pests must be examined, and disruption must be evaluated in large scale trials. Careful strategies are needed for adopting disruption control methods.

81-3065. Plimmer, J. R. (Organic Chem. Synth. Lab., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Formulation and regulation: constraints on the development of semiochemicals for insect pest management.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 403-420; 1981 (23 references).

The successful use of semiochemicals is influenced by formulation, toxicology, and registration. General properties of controlled-release formulations should include convenience in use, a constant and reproducible rate of emission for active material throughout a predetermined period, effective use of an expensive chemical, ease of application, absence of adverse effects from the chemical, and the low cost of production and application. Specific formulations discussed include microencapsulated pheromones, hollow fiber dispensers, and laminated polymeric dispensers. Knowledge of toxicology of semiochemicals is increasing. At present there is little concern that most semiochemicals in use today will present an appreciable hazard to man and his environment if present use patterns continue. Registration of pheromones in the United States has been closely linked with the registration of pesticides.

81-3066. Dover, M. J. (Benefits & Field Stud. Div., Off. Pestic. Programs, US EPA, Washington, DC 20460) **Position of the U. S. Environmental Protection Agency on regulation of biorational pesticides.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 421-423; 1981.

EPA policy on the regulation of biorational pesticides and the facilitation of the registration of these semiochemicals are discussed. In its proposed policy on regulation of biorational pesticides, issued in May 1979, the EPA recognizes that these materials are different from conventional pesticides. The policy states that the EPA will resolve outstanding safety issues and monitor probable effects on the environment and man from the use of these semiochemicals, develop guidelines for their use, review data submitted in support of their registration, and encourage the demonstration of the practical value and safety of biorational pesticides. The EPA does not consider registration to be an impediment to widespread use of semiochemicals; costs are a more serious constraint.

81-3067. Boller, E. F. (Fruit Fly Lab., Swiss Fed. Res. Stn. Fruit Grow. Vitic. & Hortic., CH-8820 Waedenswil, Switzerland) **Oviposition-deterring pheromone of the European cherry fruit fly: status of research and potential applications.** In: *Management of Insect Pests with Semiochemicals. Concepts and Practice.* Mitchell, E. R., ed. (Plenum Press: NY): pp. 457-462; 1981 (10 references).

Studies on the role of the oviposition-deterring pheromone of *Rhagoletis cerasi* are reviewed. Experiments were conducted in cherry orchards to determine the effectiveness of the pheromone under field conditions. Pheromone was collected in the lab from oviposition devices containing pheromone deposited after about 200,000 ovipositions. Pheromone solution was sprayed on 3 branches carrying 200-500 cherries each in 2 middle cherry and 4 late cherry cultivars, and on 2 entire trees of intermediate size that were late cherry cultivars. Untreated and treated cherries were examined for oviposition punctures. The pheromone showed an effectiveness of 77% in preventing fruit damage by *R. cerasi.* In subsequent field

experiments, in which the pheromone solution was concentrated by lyophilization, effectiveness levels ranged from 71 to 90%. Infestation was low despite a large pest population and favorable conditions for oviposition. The application of oviposition-deterring pheromones in combination with efficient trapping systems that attract and eliminate deterred females during their increased search for suitable oviposition sites might be developed into powerful integrated controls.

81-3068. Belasco, I. J.; Han, J. C. Y.; Chrzanowski, R. L.; Baude, F. J. (Biochem. Dep., Exp. Stn., E.I. du Pont de Nemours & Co. Inc., Wilmington, DE) **Metabolism of [^{14}C]cymoxanil in grapes, potatoes and tomatoes.** *Pestic. Sci.* 12(4): 355-364; 1981 (11 references).

Foliar-applied [^{14}C]cymoxanil, 1-(2-cyano-2-methoxyimino-[2-^{14}C]acetyl)-3-ethylurea was rapidly metabolized in grapes, tomatoes and potatoes. Furthermore, the metabolism of this fungicide was unusual in that the metabolites were found to be naturally occurring compounds, with glycine as the major metabolite. Significant levels of radioactivity were found in other amino-acids, sugars, starch, fatty acids and lignin, indicating incorporation of ^{14}C via the various metabolic pathways. (Author abstract by permission)

81-3069. Harris, R. I. (Rothamsted Exp. Stn., Harpenden, Herts AL5 2JQ, England) **The interaction between bactericidal chemicals and the wound healing process of potato tuber tissue.** *Pestic. Sci.* 12(4): 443-448; 1981 (6 references).

In vitro tests of dichlorophen against *Erwinia carotovora*, vars. *atroseptica* and *carotovara*, have shown good antibacterial activity; *in vivo* tests on potato tubers, however, showed poor control of bacterial soft rotting. Under aerobic or near anaerobic conditions, wounded potato tubers dipped in dichlorophen showed significant increases in soft rotting over water-treated tubers. Under near anaerobic conditions, neither dichlorophen-dipped nor water-dipped tubers showed evidence of wound healing. However, when incubated aerobically, a distinct wound barrier was evident in the water-dipped but not the dichlorophen-dipped tubers. To investigate the possibility that dichlorophen was inhibitory to the initiation of wound healing, an image analyzing computer was used to measure the accumulation of fluorescent products in the walls of sectioned tuber tissues treated with dichlorophen. Dichlorophen treatment resulted in very low levels of fluorescence, indicating little phenolic accumulation in the walls. Other bactericides also decreased fluorescence to some extent. (Author abstract by permission)

81-3070. Tafuri, F.; Scarponi, L.; Perucci, P.; Giusquiani, P. L. (Cent. Stud. Chem., Antiparassitari, C.N.R., Inst. Chim. Agrar. Univ., I-06100 Perugia, Italy) **Influence of some 1,3,5-triazine herbicides on peroxidase activity in corn seedlings.** *Pestic. Sci.* 12(4): 449-454; 1981 (19 references).

The effect of some 1,3,5-triazine herbicides, on the rate of oxidative decarboxylation of tryptophan by peroxidase from corn seedlings, varied with the concentration. Atrazine was stimulatory *in vitro* at 10^{-6} *M* but not at 10^{-8} *M* or lower, whereas terbutryne was inhibitory at 10^{-6} *M* but not at 10^{-8} *M* or below. Prometryne inhibited enzyme activity at 10^{-6} *M* and stimulated it at 10^{-10} *M*, while simazine caused stimulation at 10^{-6} *M* and inhibition at 10^{-10} *M* and 10^{-12} *M*. Atraton reduced enzyme activity at 10^{-6} *M* and 10^{-8} *M* but had no effect at 10^{-10} *M*. When peroxidase activity was assayed in acetone-dried powders from seeds, harvested from fields that had received typical atrazine applications, the quantities of tryptophan consumed were significantly less than the quantity determined in the control powder. From the results obtained, by incorporating dealkylated and 2-hydroxy metabolites of atrazine at 10^{-6} *M* into the culture solutions, it seems possible that the inhibition observed may have been due to the presence of 4-amino-6-ethylamino- 1,3,5-triazin-2- ol and/or 4,6-diamino-1,3, 5-triazin-2-ol residues in seeds from treated plots, even if, in previously reported experiments, analyses had not detected their presence. (Author abstract by permission)

81-3071. Hartley, G. S.; Graham-Bryce, I. J. (Palmerston North, New Zealand) **Physical principles of pesticide behaviour. The dynamics of applied pesticides in the local environment in relation to biological response. Volume 1.** (Academic Press: London): pp. 1-518; 1980.

In this book physical principles of pesticide behavior are presented. Topics considered include dosage and response; solubility, partition, and adsorption; principles of diffusion and flow; chemical transformation; behavior in soil and other porous granular materials; behavior of pesticides in air; pesticides in aquatic situations; coverage and spreading; and permeation.

81-3072. Hartley, G. S.; Graham-Bryce, I. J. (Palmerston North, New Zealand) **Physical principles of pesticide behaviour. The dynamics of applied pesticides in the local environment in relation to biological response. Volume 2.** (Academic Press: London): pp. 1-518; 1980.

This book reviews the physical principles of pesticide behavior. Topics considered include relation of permeation to toxicity; penetration of pesticides into higher plants; penetration of pesticides into insects and fungi; effects of growth and movement of organisms on interception of pesticides; and application and formulation. Nine appendixes present coefficients of molecular diffusion, vapor pressure, ionization constants, physical properties of pesticides, meteorological factors influencing pesticide behavior, drop geometry and population density, intercep-

tion of non-vertical spray by non-horizontal leaves, dimensions of organs and pests, and structural formulae of pesticides.

81-3073. Elliott, M. (Rothamsted Exp. Stn., Harpenden, Herts, England) Insecticides and fungicides department. *Rothamsted Exp. Stn. Rep.* PT 1: 119-134; 1980.

The research carried out on insecticides and fungicides at the Rothamsted Experiment Station during 1980 is reported. Studies were performed on the relationship between molecular structure and the insecticidal activity of pyrethroids, resistance in target insects, application methods, and the efficacy of some fungicides. Projects on behavioral control, including honeybee alarm pheromone, sex attracts for pea moth, and pheromones of *Ephestia kuehniella*, were also conducted. The selectivity of insecticides between beneficial and pest insects in stored products was studied. The behavior of fluometuron, aldicarb sulphone, and $Na^{36}Cl$ was studied in soils. Pea plants and *Ricinum communis* were used in tests on the systematic transport of pesticides in plants. Studies on foliar spray application systems indicated that electrostatically charged sprays produce less drift than equivalent uncharged systems, with greater deposition.

81-3074. Maugh, T. H. (Author address not given) The day of the locusts is near. *Science* 213(4509): 748; 1981.

An example of combined biological and low level chemical pest control is presented. The protozoan (microsporidia) *Nosema locustae* infects grasshopper body fat and competes for energy reserves, resulting in grasshopper sickness. Spores of the parasite can be mixed with water and sprayed onto wheat bran. Low concentrations of several pesticides are compatable with the spores. Carbaryl at 20 g/acre (20 g/0.04 ha), in combination with the spores, reduced grasshoppers by 50% in 48 hr and another 50% in 4 wk.

81-3075. Marshall, E. (Author address not given) The summer of the gypsy moth. *Science* 213(4511): 991-993; 1981.

The history of the gypsy moth in the United States is reviewed, and some of the techniques used to control it are discussed. Early control procedures primarily involved spraying with DDT. Now, however, Sevin (carbaryl) is commonly used. A synthetic sex pheromone, Disparlure, can disrupt breeding if an area is saturated. The bacteria *Bacillus thuringiensis* and a nucleopolyhedrosis virus have been effective biological control methods. These are primarily used in areas where chemical spraying is not allowed; they are less toxic than Sevin and 2-3 times more expensive. Releasing insects that are natural predators has been only slightly successful; a natural enemy that may be strong enough to control the gypsy moth is still being sought.

81-3076. Silverstein, R. M. (Coll. Environ. Sci. & For., State Univ. New York, Syracuse, NY 13210) Pheromones: background and potential for use in insect pest control. *Science* 213(4514): 1326-1332; 1981 (22 references).

A discussion of the failure of pesticides to satisfactorily control insect pests is presented. The use of pheromones as an alternative control for the regulation of insects is discussed. Pheromones can be used to trap insects, lure them to circumscribed areas that are treated with insecticides, and to disrupt mate-finding or aggression. Case histories of integrated pesticide-pheromone treatment are presented. Pheromones are becoming an important component of integrated pest management. More rapid distribution of the technology to users is needed.

81-3077. Van Logten, M. J.; Gupta, B. N.; McConnell, E. E.; Moore, J. A. (Natl. Inst. Public Health, 3720 Bilthoven, The Netherlands) The influence of malnutrition on the toxicity of 2,3,7,8-tetrachlorodibenzo- *p*-dioxin (TCDD) in rats. *Toxicology* 21(1): 77-88; 1981 (15 references).

A single oral dose of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) (20 or 40 μg/kg body wt), a trace contaminant in pesticides, was administered to rats, resulting in reduced body wt gain, water intake, degenerative changes in the liver, and involution of the thymus. In an experiment with caloric malnourished rats, a restricted diet alone was found to cause thymic involutions. However, TCDD (10 or 20 μg/kg body wt) produced additional severe atrophy of the thymus. The effects of TCDD (20 μg/kg body wt) were tested in rats fed a low, normal, or high protein diet (3.5%, 26%, or 55% casein). The effect of TCDD on body wt and liver was more severe in rats given a low protein diet. No relationship between protein level and the effect of TCDD on the thymus was apparent. Since it is unlikely that the influence of TCDD on the thymus is related to malnutrition, the authors suggest that other mechanisms, such as direct effect of TCDD on the thymus, interferences of TCDD with liver factor, or a depletion of energy reserves, may be involved.

81-3078. United Nations Trends in Airborne Equipment for Agriculture and Other Areas. (Pergamon Press: Oxford): 358 pp.; 1980.

In this book the proceedings of a seminar organized by the United Nations Economic Commission for Europe, held in Warsaw, from 18-22 September 1978, are presented. The role of airborne equipment is examined from economic, technical and environmental angles; con-

clusions are presented regarding each aspect. A need for new methods which are more effective and economical with fewer adverse environmental effects is suggested, and an interdisciplinary approach is recommended. The control of diseases affecting forest vegetation is concluded to be a field in which replacement of traditional methods is especially important. Abstracts of chapters from this book will appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-3079. Druzynski, J. (Swietokrzyski Natl. Park, Bodzentyn, Poland) **Helicopter as a means for protecting the natural environmental of the Swietokryski National Park.** In: *Trends in Airborne Equipment for Agriculture and Other Areas.* (Pergamon Press Ltd: Oxford): pp. 305-312; 1980 (French).

The use of helicopters in the spraying of the Primeval Fir Forest in Poland for control of the fir tortricid is described. The bacterial preparation Dipel (*Bacillus thuringiensis*) was sprayed over an operation area of 546 ha in 1976 and 341 ha in 1977. The operation was performed at a rate of 84 ha/hr, for a sprinkling intensity of 1 kg/ha. Results indicated that 54-80% of the caterpillars were destroyed. These results were concluded to be due to good vertical and horizontal penetration of liquid droplets across dense crowns of trees, and uniform spreading of the preparation over the operation strip.

81-3080. Kucera, D. R.; Orr, P. W. (For. Serv., USDA, Broomall, PA) **Spruce budworm in the eastern United States.** *US For. Serv. For. Insect Dis. Leafl.* 160: 7 pp.; 1981.

Adverse weather, diseases, predators, and parasites play a significant role in the natural control of the spruce budworm. Parasitic wasps, such as *Meteorus trachynotus* and *Rhaeogenes hariolus*, and a tiny parasitic fly, *Lypha setifacies*, have been noted among declining budworm populations. However, under ideal conditions for budworm growth, the population may spread beyond the control of these natural agents. Use of biological insecticides, silvicultural practices, and chemical insecticides has been developed into a integrated pest management system. Biological insecticides are about 30-fold more expensive than conventional chemical insecticides. Neither viruses nor fungi have provided sufficient control in field trials. The bacterial pathogen, *Bacillus thuringiensis*, has effectively controlled moderate populations of < 50 larvae/18-inch branch. Indirect control can be achieved by forest management practices that include increasing use of balsam fir, regulating age classes to prevent the occurrence of overmature balsam fir over large areas, and favoring or planting less susceptible species, such as white pine.

81-3081. Dutt, T. E.; Harvey, R. G. (Monsanto Agric. Prod. Co., Fresno, CA 93710) **Pronamide phytotoxicity in 10 Wisconsin soils.** *Weed Sci.* 28(4): 429-432; 1980 (15 references).

Pronamide [3,5-dichloro-(*N*-1,1-dimethyl-2-propynyl) benzamide] phytotoxicity was compared in 10 Wisconsin soils and the relationship of activity to soil physical and chemical properties appraised. Twelve soil properties were measured and correlated with pronamide I50 (50% fresh wt inhibition) values using oats (*Avena sativa* L. Portal) as the indicator plant in bioassays conducted under greenhouse conditions. Organic matter was the soil variable most inversely correlated with pronamide phytotoxicity. Cation exchange capacity, field moisture capacity, and Mg content were also inversely correlated with pronamide phytotoxicity, but probably reflect changes in soil organic matter levels. Clay content did not significantly affect pronamide phytotoxicity. (Author abstract by permission)

81-3082. Steinback, K. E.; Pfister, K.; Arntzen, C. J.* (MSU-DOE Plant Res. Lab., Michigan State Univ., East Lansing, MI 48824) **Trypsin-mediated removal of herbicide binding sites within the photosystem II complex.** *Z. Naturforsch. Teil C* 36(1-2): 98-108; 1981 (27 references).

Studies were conducted on the modification of the surface of chloroplast thylakoids by treatment with trypsin. Chloroplasts were isolated from pea or spinach leaves and incubated in the presence of trypsin. Herbicide binding assays were conducted as follows. Known quantities of herbicides were introduced to the incubation mixtures. Chloroplasts were then collected and the concentration of pesticide remaining in solution was determined. Assays of photosynthetic reactions were conducted on isolated spinach thylakoid membranes. Trypsin treatment reduced the activities of atrazine, diuron, pyrazon, (chloridazon) and bromacil. However, the activities of bromnitrothymol and dinoseb increased. When inhibition occurred, it corresponded to a decreased binding affinity of the trypsin-treated membranes. It appears that a 32,000 dalton polypeptide is an integral part of the binding site for atrazine. However, polyacrylamide gel electrophoresis revealed that several polypeptides are exposed on the membrane surface.

81-3083. Kurihara, N.; Ohisa, N.; Nakajima, M.; Kakutani, T.; Senda, M. (Radiosot. Res. Cent., Kyoto Univ., Kyoto 606, Japan) **Relationship between microbial degradability and polarographic half-wave potential of polychlorocyclohexenes and BHC isomers.** *Agric. Biol. Chem.* 45(5): 1229-1235; 1981 (12 references).

Partially purified, cell-free extracts of *Clostridium rectum* effectively degraded lindane (γ-BHC) and related polychlorocyclohexanes, in the presence of dithiothreitol. The first step of the reaction was proved to be reductive dechlorination. These compounds were also reductively dechlorinated by polarography. The half-wave potentials had a linear relationship to the logarithmic values of the biodegradation rates. (Author abstract by permission)

81-3084. Kovac, J.; Kovacicova, J.; Batora, V.; Hankova, A. (Author address not given) **Rezidua trimorfamidu v polnohospodarskych plodinach [Trimorfamide residues in agricultural products.]** *Agrochemia* 21(4): 115-116; 1981 (Slovak).

Fademorf EK-20 (20% trimorfamide) residues on different varieties of apple, grape, and gooseberry crops were determined at various growth stages following application. Apples treated with a 0.125% preparation contained 0.8 mg/kg 2 wk following treatment. The residue was 0.18 mg/kg when 0.25% was used. In currants, the residues were 2.21 and 2.5 mg/kg, respectively, 3 and 5 days following the last spraying. On crops such as cucumbers, melons, and apples (small surface:mass ratio) residue levels were low. In crops such as currants, gooseberries, and grapes, it was concluded that spraying must be timed to minimize contamination. In cereals, trimorfamide residues were not a problem, due to the longer time between treatment and harvest.

81-3085. Risebrough, R. W.; de Lappe, B. W.; Walker, W.; Springer, A. M.; Firestone-Gillis, M.; Lane, J.; Letterman, E. F.; Shropshire, J. C.; Vick, R.; Sistek, W.; Newton, A. S. (Bodega Mar. Lab., Univ. California, Bodega Bay, CA 94923) **Patterns of hydrocarbon contamination in California coastal waters.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 33-40; 1980 (8 references).

The effect of human activities on the chemical composition of coastal waters of California was investigated. Mussels were used as the indicator organism. Petroleum and petroleum-derived compounds were found, probably resulting from contamination caused by a natural petroleum seep. Mass chromatographic analysis revealed hopanes, steranes, and monoaromatic steranes, which are compounds present in crude oils. Flame ionization glass capillary chromatographs of extracts of the dissolved and particulate phases of seawater obtained on the transect off the Palos Verdes Peninsula and of mussels at Royal Palms indicate the presence of DDE, PCB, pristane, and squalene.

81-3086. Pavlou, S. P.; Dexter, R. N.; Hom, W. (Aquatic Ecosystems Program, URS Co., Seattle, WA 98121) **Characterization of chlorinated hydrocarbons in the marine environment: sampling and analytical aspects.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 185-196; 1980 (13 references).

A brief description of equipment used for determining residues of chlorinated hydrocarbons in the marine environment is presented. A computational scheme for determining PCBs in natural samples is also discussed. Sampling devices include a large volume filter and specifically designed plankton nets to avoid surface film contamination. A modified gas chromatographic spectral analysis technique was used to determine individual component concentrations for PCBs. The computational scheme described has been computerized to facilitate the reduction of the voluminous raw data. Concentrations of PCB and ΣDDT in zooplankton samples from Elliot Bay, Puget Sound, are presented in tabular form.

81-3087. Hites, R. A. (Dep. Chem. Eng., Massachusetts Inst. Technol., Cambridge, MA 02139) **Computerized GC/MS for solving problems in water pollution.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 281-292; 1980 (4 references).

The movement of various industrial chemicals was traced from their origin, through the Delaware River, and into the drinking water of Philadelphia. Discharges from one of the plants studied went into the city sewer along with effluents from other industrial users. These wastes were treated at the Northeast Sewage Treatment plant using classical secondary treatment methods. The treated effluent was discharged into the Delaware River, at river mile 104. Water flow at this segment of the river is dominated by tidal movement rather than downstream river flow. The concentrations of 84 compounds observed at various sampling sites are presented in tabular form; the compounds included DDE and the herbicide 2,5-dichloro-N(1, 1-dimethyl-2-propyl) benzamide. The compounds of greatest environmental significance and biological activity were found to be the least affected by the waste treatment process. Those chemicals which were significantly reduced in concentration were primarily reduced due to dilution in large quantities of water.

81-3088. Goldberg, E. D. (Scripps Inst. Oceanogr. Univ. California San Diego, La Jolla, CA 92093) **The surveillance of coastal marine waters with bivalves – the mussel watch.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 373-386; 1980 (4 references).

Monitoring of heavy metals, petroleum hydrocarbons, synthetic organics, and artificial radionuclides has been carried out with the help of sentinel organisms such as

bivalves, oysters and mussels. Through such efforts, zones of high pollution have been identified. The strategies involved in carrying out this monitoring program, including collection techniques and analytical procedures, are described. Various degrees of pollution were found in the 1976 and 1977 analyses. A remarkable similarity was noted in the concentrations of some heavy metals and plutonium in the organisms collected from a given station during yr 1 and 2 of the monitoring program. There is some expectation that in the future other pollutants might be included in the monitoring program. Degradation products of DDT, *p,p'*-DDE, and *p,p'*-DDD (TDE) were monitored along with PCB 1254 in monthly samples.

81-3089. Pavlou, S. P. (Aquatic Ecosystems Program, USR Co., Seattle, WA 98121) **Environmental dynamics of trace organics contaminants in estuarine and coastal zone ecosystems.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 387-399; 1980 (4 references).

Distribution and bioaccumulation of manmade trace organic compounds in the marine environment are discussed in terms of the physical/chemical processes that control their flow throughout the ecosystem. Data presently available suggest that biological uptake is predominantly governed by equilibrium partitioning of the chemicals between biota and ambient water. Studies suggest that the sediments can provide a rapid assessment of the mean residue levels and dynamics of persistent organic chemicals; on a mass basis sediments will always contain higher concentrations of residues and can be easily sampled and analyzed. A general expression for the distribution coefficient of non-polar organic compounds at the sediment-seawater interface is presented. The equation is then used to predict the behavior of Kepone (chlordecone) on various particles sizes at different organic loadings. Prediction of ecosystems distribution is also considered; PCBs are used as an example.

81-3090. Briggs, G. G. (Dep. Soil Sci. Plant Nutr., Univ. Western Australia, Nedlands, Western Australia 6009) **Adsorption of pesticides by some Australian soils.** *Aust. J. Soil Res.* 19: 61-68; 1981 (11 references).

Surface and subsoil samples were taken and ground to pass through a 2 mm mesh. Organic content of the samples ranged from 0.19 to 6.62%. Soil acidity ranged from a pH of 5.2 to 8.4. In experiments designed to mirror field conditions, 8 herbicides and permethrin were applied at 2.6 kg/ha to the surface of soil in 5-cm diameter pipes. The herbicides used were fenuron, simazine, monolinuron, metobromuron, chlortoluron, diuron, linuron, and chlorbromuron. After 10 cm of rain had fallen on sandy soil, the highest concentrations of each herbicide were found in the top 2.5 cm. A second maximum concentration for simazine and fenuron occurred at 10-15 cm. Fenuron had been almost completely leached from the 5-10-cm layer. Permethrin was very strongly absorbed by soils, and was found only in the surface layer after 10 or 20 cm of rainfall. It was concluded that soil adsorption and leaching of nonionized chemicals can be predicted from their octanol/water distributions.

81-3091. Horii, S.; Miyazaki, T.; Kaneko, S.; Akiyama, K.; Yamagishi, T. (Tokyo Metrop. Res. Lab. Public Health, 24-1, 3-chome, Hyakunin-cho, Shinjuku-ku Tokyo, 160 Japan) **Identification of gamma-chlordene in freshwater fish from the Tama River.** *Bull. Environ. Contam. Toxicol.* 26(2): 254-257; 1981 (8 references).

The identification of a previously unknown gas chromatographic peak observed during analysis of the freshwater fish *Zacco platypus* collected from the Tama River, Japan, is described. The unknown peak had been observed before that of *trans*-nonachlor on OV-17 column in PCB fraction. In order to identify the peak, the whole body fish samples were homogenized with sodium sulfate, extracted with n-hexane, chromatographed repeatedly, then subjected to GC-MS analysis. Preliminary tests showed the unknown substance to be more sensitive to ECD than FID, not affected by refluxing with methanolic KOH solution, unchanged by concentrated sulfuric acid treatment, and extracted into acetonitrile on partitioning with hexane. A study of the MS fragmentation patterns identified the substance as γ-chlordene (2,3,3a,4,5,8-hexachloro- 3a,6,7,7a-tetrahydro- 1,6-methano-1 H-indene). γ-Chlordene is a major constituent of technical chlordane, which is used in Japan for the control of termites in wooden structures. The approximate concentration of γ-chlordene in this sample was 23 ppb (wet basis), which was relatively low compared with values of the other organochlorines analyzed.

81-3092. Tanabe, S.; Tanaka, H.; Tatsukawa, R.; Nakamura, I. (Fac. Agric., Ehime Univ., 5-7, Tarumi-3, Matsuyama 790, Japan) **[Organochlorine compound residues in several species of fishes caught off Chile.]** *Bull. Jpn. Soc. Sci. Fish.* 46(6): 763-769; 1980 (44 references) (Japanese).

Analyses of PCBs, DDT and its metabolites, and BHC isomers were performed on several species of fish caught off the coast of Chile. PCB levels ranged from 0.1 to 2.2 ng/g, and were lower than values reported from the Northern Hemisphere. ΣDDT (DDT + DDE + TDE) ranged from 0.3 to 13 ng/g, with mean values for DDE (the most common form) ranging from 0.2 ng/g in *Coelorhynchus fasciatus* to 3.2 ng/g in *Cheiloducytlus* sp. β-BHC and γ-BHC (lindane) were below the detection level (< 0.02 ng/g). α-BHC ranged from 0.11 to 0.25 ng/g. γ-BHC ranged from 0.03 to 0.10 ng/g.

81-3093. Jensen, K.; Randlov, A.; Riisgard, H. U. (Mar. Pollut. Lab., Kavalergaarden 6, DK 2920 Charlottenlund, Denmark) **Heavy metal pollution from a point source demonstrated by means of mussels, *Mytilus edulis*.** *Chemosphere* 10(7): 761-765; 1981 (8 references).

A program is described in which mussels *Mytilus edulis* were analyzed for mercury to demonstrate mercury pollution from a point source. When mercury-containing insecticides were banned in the 1960s, these compounds were disposed of in dunes close to the North Sea shore, and it was suspected that the compounds were washing into the sea. Mussels were collected at 10 stations, and soft parts were analyzed for mercury by neutron activation analysis. The mercury levels found show a heterogenous distribution, demonstrating a load of mercury from a point located near the deposit. In addition, mussels collected from stations located near the deposit show low wt of soft parts, which is known to be a result of environmental conditions. The study demonstrates the applicability of *M. edulis* as a chemical monitoring organism for the monitoring of mercury pollution.

81-3094. Paasivirta, J.; Sarkka, J.; Pellinen, J.; Humppi, T. (Dep. Chem., Univ. Jyvaskyla, F-40100 Jyvaskyla 10, Finland) **Biocides in eggs of aquatic birds. Completion of a food chain enrichment study for DDT, PCB, and Hg.** *Chemosphere* 10(7): 787-794; 1981 (17 references).

Studies were conducted on the eggs of 7 species of fish-eating aquatic birds at Lake Paijanne, Finland. Eggs were analyzed for hexachlorobenzene (HCB), DDE, PCB, and mercury. Levels of contaminants varied significantly between species. HCB ranged from 0.020 to 0.74 μg/g; DDE ranged from 0.63 to 10.14 μg/g; PCB ranged from 1.35 to 11.83 μg/g; and total mercury ranged from 0.37 to 1.92 μg/g. The overall average methyl mercury was 85.5% of total mercury, which compared closely with values reported to be present in fish. The levels of biocides in the eggs, juveniles, and adults of 2 species were compared. Levels for all compounds were highest in adults, and usually lowest in eggs.

81-3095. Tausch, H.; Stehlik, G.; Wihlidal, H. (Forschungszent. Seibersdorf, Inst. Biol., A-2444 Seibersdorf, Austria) **Analyse von organochloropestizid- und PCB-ruckstanden in fischen mittels kapillargaschromatographie/massenspektrometrie. [Analysis of organochlorine pesticides and PCB residues in fish by capillary gas chromatography/mass spectrometry.]** *Chromatographia* 14(7): 403-410; 1981 (18 references) (German).

A method for the determination of neutral organochlorine compounds in fish is presented. The method employs extraction, selective clean-up, and GC/MS determination using glass capillary columns. Results are reported from typical fish samples from Upper Austrian rivers. Relatively low amounts of pesticide residues were found, in contrast to a detected PCB concentration of 6.1 ppm.

81-3096. Hansen, P. D. (Inst. Hydrobiol. & Fischeriwissenschaft, Univ. Hamburg, D-2000 Hamburg 50, BRD) **Uptake and transfer of the chlorinated hydrocarbon lindane (γ-BHC) in a laboratory freshwater food chain.** *Environ. Pollut. Ser. A* 21(2): 97-108; 1980 (14 references).

Studies were designed to determine the relative importance of food and water as sources of lindane (γ-BHC). The experimental food chain was made up of *Chlorella* sp., *Daphnia magana*, and the stickleback *Gasterosteus aculeatus*. The system was exposed to lindane in the water at concentrations of 10-100 μg/l. In addition, uptake from food was tested by feeding contaminated *Chlorella* to *Daphnia*, which was then fed to *G. aculeatus*. Adsorption on glass walls and accumulation in the various organisms were determined, and accumulation factors were calculated. Uptake from water was very rapid, while the uptake via food occurred relatively slowly. *Daphnia* showed definite damage, including irritation and 50% reduction in reproductive rate, due to sublethal concentrations of lindane. Among fish exposed to lindane via food, accumulation/day amounted to about 50% of that given the fish. When the results were compared in the form of a model, it was determined that the lindane concentration in the last link does not increase in direct proportion to the precontamination of the primary producers.

81-3097. Yeadon, R.; Perfect, T. J. (Cent. Overseas Pest Res., Coll. House, London W8 5SJ, England) **DDT residues in crop and soil resulting from application to cowpea *Vigna unguiculata* (L.) Walp. in the sub-humid tropics.** *Environ. Pollut. Ser. B* 2(4): 275-294; 1981 (27 references).

The distribution of DDT spray in plants and soil was evaluated after application by knapsack sprayer to a Nigerian cowpea *(Vigna unguiculata)* crop. The insecticide was sprayed at a rate of 10 kg AI/ha in each of 2 growing seasons/yr for 4 yr. Dye recovery and crop cover estimation studies showed a 1:3 partition of DDT between crops and soil, respectively. Gas liquid chromatographic analyses of soil and crop residues revealed a disappearance rate of about 60% of the applied dose of pesticide. ΣDDT residues reached a maximum of 1.7 μg/g after 3 spraying seasons, and declined thereafter. After 4 yr, the plots treated with a total of 70 ½g AI/ha retained only 2-3% of the applied DDT in the soil.

81-3098. McIntyre, A. E.; Lester, J. N.*; Perry, R. (Public Health Eng. Lab., Civil Eng. Dep., Imperial Coll.,

London SW7 2AZ, England) **The influence of chemical conditioning and dewatering on the distribution of polychlorinated biphenyls and organochlorine insecticides in sewage sludges.** *Environ. Pollut. Ser. B* 2(4): 309-320; 1981 (27 references).

The effect of conditioning and dewatering processes on the distribution of PCBs and organochlorine insecticides (*p,p'*-DDE, lindane, dieldrin) in sewage sludges was examined at 2 wastewater treatment plants. No differences were noted in the amount of PCBs and organochlorine insecticides recovered from sludge cakes produced by either facility. One process used coagulation of primary digested sludge with aluminum chlorohydrate followed by dewatering with vacuum filtration; the other facility conditioned the consolidated mixed primary sludge with Zetag 945 polyelectrolyte, and then dewatered it by pressure filtration. A mass balance evaluation of solids and organic micropollutants showed a close association of PCBs and organochlorine insecticides with the solid matter in sewage sludges.

81-3099 Dillon, J. C.; Martin, G. B.; O'Brien, H. T. (Cent. Rech. Nutr., Univ. Laval, Cite Univ., Quebec, Canada) **Pesticide residues in human milk.** *Food Cosmet. Toxicol.* 19(4): 437-442; 1981 (27 references).

A total of 154 samples of human milk collected 3-6 days after parturition were obtained from 4 hospitals in Quebec. Samples were analyzed by electron-capture gas-liquid chromatography for ΣDDT (DDT + DDE), aldrin, γ-HCH (lindane) and polychlorinated biphenyls (PCBs). In 93% of the milk samples the PCB levels exceeded that equivalent to the Acceptable Daily Intake proposed by the USA for PCBs, the mean PCB level (± SD) for the 154 samples being 0.837 ± 0.529 mg/kg milk fat. The Codex Alimentarius Commission maximum residue limits were exceeded in 30% of the samples with regard to ΣDDT (mean ± SD 1.087 mg/kg milk fat) and in 3% with regard to γ-HCH (0.047 ± 0.131 mg/kg) and aldrin (0.041 ± 0.068 mg/kg). The age of the donors showed a positive correlation with PCB concentrations, while previous breast-feeding was inversely correlated with γ-HCH levels. A significant positive correlation was observed between cigarette smoking and the DDE content of human milk fat. Also of importance were the higher levels of PCB associated with residence in an industrialized area. (Author abstract by permission)

81-3100. Anonymous (Dep. Pest Control., Hiroshima Prefect. Agric. Exp. Stn., Higashi-hiroshima, Hiroshima, Japan) **[Investigation of pesticide residues on agricultural products.]** *Gyomu-nenpo (Ann. Rep. Hiroshima Prefect. Agric. Exp. Stn.)* pg. 23; 1980 (Japanese).

Pesticide residues were studied following application of chlorthal-dimethyl (DCPA) to lettuce, PCNB (Quintozene) to rough rice and rice straw, and hydroxyisoxazole (5-methylisoxatol- 3-ol) to rough rice and rice straw in 1980. Residues were also investigated in fruits of satsuma orange grown on soil to which chlorthal-dimethyl had been applied; chlorfenethol had also been applied to the fruit tree. Residues of chlorthal-dimethyl on lettuce increased at later harvest dates. PCNB residues were not detected in rough rice and were detected in rice straw in very small amounts. Potato and rape were grown in soil treated with PCNB, followed by planting of another rape crop after harvest. PCNB residues in potato were higher than in rape. The half-life of PCNB in the soil was ~ 100 days.

81-3101. Sahu, D.; Pattanaik, M. (Orissa Univ. Agric. Technol., Bhubaneshwar, Orissa 751003, India) **Persistence of Rogor in some Orissa soils.** *Indian J. Agric. Sci.* 50(6): 505-507; 1980 (3 references).

Tests were carried out to determine the persistence of the insecticide Rogor (dimethoate) in 3 cultivated soils under sterile and non-sterile conditions. Soil samples were moistened to field capacity prior to addition of Rogor at 5 ppm. Samples were collected after 0, 5, 10, 15, 20, 30, 45, 60, and 75 days of incubation and were analyzed for Rogor residues. The rate of degradation was similar in all 3 soils; Rogor persisted for 45 days in non-sterile and 75 days in sterile soils. The degradation rate was highest in the soil with the highest pH because organophosphates are unstable under alkaline conditions. The rate of degradation followed a first-order reaction. The half-life of Rogor ranged from 9.1 to 10.6 days in non-sterile and 16.2 to 17.5 days in sterile soil. It was concluded that Rogor is a non-persistent insecticide.

81-3102. Golovenko, V. K.; Shchepinsky, A. A.; Shevchenko, V. A. (State Oceanogr. Inst. Odessa, USSR) **Akkumulirovanie DDT i ego metabolizm v organizme chernomorskoi midii. [Accumulation of DDT and its metabolism in Black Sea mussels.]** *Izv. Akad. Nauk SSSR Ser. Biol.* 4: 543-550; 1981 (22 references) (Russian).

Studies carried out on Black Sea mussels demonstrated that DDT was absorbed from the environment; accumulation occurred in gonads and hepatopancreas. Detoxification of DDT was achieved by dechlorination to DDD (TDE). DDT elimination was slow. It was suggested that the Black Sea mussels may serve as indicator organisms for determination of the presence of DDT in the sea.

81-3103. Heikes, D. L.; Griffitt, K. R. (Food & Drug Admin., Kansas City, MO 64106) **Pentachlorophenol in Mason jar lids and home canned foods.** *J. Assoc. Off. Anal. Chem.* 63(5): 1125-1128; 1980 (4 references).

A method was developed for the determination of

pentachlorophenol (PCP) in the seals and enamel of Mason lids. After extraction with acidic CH_2Cl_2 and methylation, the resulting pentachloroanisole was determined by gas-liquid chromatography (GLC) with electron capture detection (EC). Three of the 9 brands of lids examined contained PCP. Levels were as high as 198 μg/lid. Recoveries from fortified samples ranged from 92 to 103%. Six fruits and vegetables were canned by home canning techniques, using lids shown to contain PCP. PCP in these foods was determined by a procedure specifying extraction with acidic CH_2Cl_2 and gel permeation chromatography cleanup. Extracts were methylated and determined by GLC-EC. PCP was found in all the canned foods. Levels were as high as 16 μg/qt (μg/0.946 l). Recoveries from foods fortified with PCP ranged from 85 to 94%. The presence of PCP was confirmed by GLC-mass spectrometric determination of the derivative, pentachloroanisole. (Author abstract by permission)

81-3104. Pike, K. S.; Getzin, L. W. (Dep. Entomol., Washington State Univ., Irrigated Agric. Res. & Ext. Cent., Prosser, WA 99350) **Persistence and movement of chlorpyrifos in sprinkler-irrigated soil.** *J. Econ. Entomol.* 74(4): 385-388; 1981 (8 references).

The chemical persistence and vertical movement of chlorpyrifos 4EC in a loam soil were compared with respect to time of posttreatment sprinkler irrigation. Irrigation intervals of 0, 2, and 6 days posttreatment, together with a nonirrigated control, were assessed. Sprinkler irrigation (2 ha-cm of water) immediately after insecticide treatment reduced the dissipation rate of chlorpyrifos compared with delayed irrigation or no irrigation. Chemical persistence was least in nonirrigated plots. Chlorpyrifos dissipation rates were rapid during the 2 wk after treatment. Thereafter, chlorpyrifos dissipation proceeded more slowly in all plots but relative rates were greater in nonirrigated plots. Vertical movement of the insecticide in the soil after sprinkler irrigation was minimal; greater than 99% of the total chlorpyrifos residue were found in the top 2.5-cm layer. (Author abstract by permission)

81-3105. Hildebrand, S. G.; Strand, R. H.; Huckabee, J. W. (Oak Ridge Natl. Lab., Oak Ridge, TN 37830) **Mercury accumulation in fish and invertebrates of the North Fork Holston River, Virginia and Tennessee.** *J. Environ. Qual.* 9(3): 393-400; 1980 (48 references).

We investigated both total and methylmercury accumulation in fish and invertebrates in the North Fork of the Holston River below a currently inactive chloralkali plant to quantify the extent of contamination; to determine what proportion of the variance in mercury concentration in fish can be explained by mercury concentration in water, sediment, benthic invertebrates; and to determine what proportion of mercury concentration in benthic invertebrates can be explained by mercury concentration in water and sediment. Fish species [rock bass (*Ambloplites rupestris*) and hog sucker (*Hypentelium nigricans*)] and benthic invertebrates were collected from stations above and below the plant, and axial muscle (fish) or whole animal (invertebrates) was analyzed for total mercury by flameless atomic absorption and for methylmercury by gas chromatography. The relation of total mercury concentration to fish wt and factors affecting mercury concentration in fish and invertebrates were examined through regression analysis. Total mercury concentration in fish and benthic invertebrates decreased with distance below the plant. Significant linear regressions of total mercury concentration on fish wt were observed for some, but not all, samples examined. Mercury in the methyl form comprised 91.7% of total mercury in fish analyzed, while approximately 50% of the mercury in invertebrates was methylmercury. Multiple regression analysis indicated 96.4% of the variance in total mercury concentration in rock bass and 80.5% in hog suckers was accounted for by mercury in water, sediment, and benthic invertebrates. Independent variables accounted for 97.4% of the variance in total mercury concentration in benthic invertebrates. The potential implication of these results for environmental monitoring programs is discussed. (Author abstract by permission)

81-3106. Butler, L. C.; Staiff, D. C.; Sovocool, G. W.; Wilson, N. K.; Magnusen, J. A. (Wenatchee Pestic. Res. Branch, Environ. Toxicol. Div., Health Effects Res. Lab., US EPA, Wanatchee, WA 98801) **Reductive degradation of dieldrin and endrin in the field using acidified zinc.** *J. Environ. Sci. Health B* B16(4): 395-408; 1981 (20 references).

The degradation of dieldrin and endrin in soil slurries containing powdered zinc, dilute acetic acid and acetone was studied to assess the possibility of field disposal of small quantities of these insecticides. The extent of reductive dechlorination of emulsifiable concentrates was determined by GC-MS analysis of reaction products. Complete conversion of endrin and partial conversion of dieldrin to products formed by replacement of the bridge *anti* chlorines with hydrogen was confirmed by NMR spectral analysis. Accelerated destruction of parent compounds was also achieved with the present procedure when the pesticides were applied to an outside soil plot over a 2.5-yr period. The *anti* dechloro products are thought to be safer and much less toxic than the parent compounds.

81-3107. Miles, J. R. W.; Tu, C. M.; Harris, C. R. (Res. Cent., Agric. Canada, Univ. Sub Post Office, London, Ontario N6A 5B7, Canada) **A laboratory study of the persistence of carbofuran and its 3-hydroxy- and 3 keto-metabolites in sterile and natural mineral and organic soils.** *J. Environ. Sci. Health B* B16(4): 409-417; 1981 (10 references).

The persistence of carbofuran and its 3-hydroxy-

and 3-keto-metabolites in sterile or natural organic (muck), and sterile or natural mineral (loam) soils was evaluated in a 16-wk laboratory study. After 8 wk, 77% of the insecticide remained in the sterile muck, and about 50% remained in the sterile loam. In the natural muck, 25% of the initial carbofuran was present after 8 wk; in the natural loam it had completely disappeared. After 1 wk, 50% of the 3-ketocarbofuran and only 10% of the 3-hydroxycarbofuran remained. 3-Hydroxycarbofuran disappeared completely in 2 days from natural loam and in 3 days from natural muck. The 3-ketocarbofuran produced from 3-hydroxycarbofuran reached maximum levels in 1 day and disappeared by 4 days in loam and 7 days in muck.

81-3108. Pokharkar, D. S.; Dethe, M. D. (Dep. Entomol., Mahatma Phule Agric. Univ., Rahuri, Maharashtra 413722, India) **Gas-liquid chromatographic studies on residues of endosulfan on chilli fruits.** *J. Environ. Sci. Health B* B16(4): 439-451; 1981 (11 references).

The dissipation of endosulfan and its isomers on green fruits of chilli (*Capsicum annuum* Linn.) was examined by gas liquid chromatography (GLC). Fifty-day old chilli seedlings were treated with 4 sprayings of 0.03 or 0.08% endosulfan 3 times. Fruits were randomly collected after each treatment, and the insecticide residues were extracted into a benzene:isopropanol mixture. After cleanup by column chromatography and analysis by GLC, regression equations for dissipation of residues, half-life values, and times required to reach tolerance limit were calculated. The half-life of endosulfan was < 2 days, and the waiting periods for the 0.03 and 0.08% endosulfan doses were estimated to be 5 and 7 days, respectively. α-Endosulfan dissipated more rapidly than β-endosulfan. Washing with tap water was very effective in reducing the amount of endosulfan remaining on the chilli fruits.

81-3109. DeWalle, F. B.; Norman, D.; Sung, J.; Chian, E. S. K.; Giabbai, M. (Univ. Washington, Seattle, WA) **Organics.** *J. Water Pollut. Control Fed.* 53(6): 659-678; 1981 (165 references).

Organic determinations in a wide variety of environmental and laboratory samples were culled from the literature and are presented in this review. Advanced analytical techniques for the determination of pesticides, chlorinated hydrocarbons, and related compounds in environmental samples usually relied on capillary GC columns with liquid phases, such as OV-101, SE-54, or Carbowax 20M. Single or multiple stage cleanup was generally required to separate the pesticides from the background organics. Preconcentration on solid sorbents such as XAD-2, carbon block, polyurethane or Tenax was required when the organics were present at low concentration. Although the EC detector was most commonly used, plasma emission, infrared, and nitrogen detectors have also been used. Pesticide residues were reported in water, air, soil, fish, shellfish, human adipose tissue, human semen, rice bran, strawberries, straw, apples, sediments, lobster, jellyfish, and other substances. Biodegradation was noted for many pesticides, although degradation generally diminished with increasing substitution of the ring structure of the compound and increasing chlorine number, and increased with greater bacterial activity and nutrient concentration of the sample.

81-3110. Anonymous (Dep. Foodst. & Nutr., Kagoshima Prefect. Inst. Environ. Pollut. & Public Health, Kagoshima, Japan) **[Investigation of pesticide residues in foodstuffs.]** *Kagoshima-Ken Kogai Eisei Kenkyushoho (Rep. Kagoshima Prefect. Inst. Environ. Pollut. Public Health)* 16: 27-32; 1980 (Japanese).

Pesticide residues (ΣBHC, ΣDDT, dieldrin, and organophosphorus pesticides) were investigated in 58 specimens of 25 kinds of cereals, legumes, vegetables, and fruits. The pesticide content and number of specimens in which pesticide was detected are reported. BHC residues were 0.001 ppm in 2 of 3 samples of summer orange. DDT was detected at 0.001 ppm in the 1 cabbage sample. Dichlorvos was detected at 0.01 ppm in 1 of 4 Japanese radish samples. Fenitrothion was found at 0.029 ppm in 1 of 2 strawberry samples. EPN was measured at 0.528 ppm in 1 of 1 cabbage sample. The cabbage in which such a large residue of EPN was detected was marketed 7 days after EPN application. Pesticide residues were examined on 17 specimens of commercial milk. BHC was detected in all specimens in the range of 0.001 to 0.004 ppm. DDT was detected in 15 specimens in the range of not detectable to 0.003 ppm. Dieldrin was detected in 1 specimen at 0.001 ppm.

81-3111. Ionchev, D.; Bardarov, V. (Author address not given) **Sudurzhanie na DDT v kruvta na lettsi ot selskostopanskata aviatsiva. [DDT blood levels in agricultural aviation pilots.]** *Khig. Zdraveopaz.* 23(3): 220-225; 1980 (5 references) (Bulgarian).

To determine possible occupational exposure to DDT, gas chromatographic determinations of DDT and its metabolites were carried out in blood of agricultural pilots working with DDT and of pilots not working with DDT. Although the average values found were not alarming, it was determined that the DDT content in the blood of pilots working with DDT was significantly higher than that of the pilots not using DDT. Occupational exposure is suggested by the relationship between the concentrations of DDT and p,p'-DDE. Six percent of the pilots showed DDT concentrations above 0.070 mg/l. The results indicate that monitoring of crews using DDT and some other pesticides is warranted; and it is recommended that only pilots with a total DDT level in the blood of below 0.10 mg/l be allowed to work with DDT.

81-3112. Shirko, T. S.; Kharitonova, A. P. (Author address not given) **Ostatki gerbitsidov v pochve i rasteniyakh luka. [Herbicide residues in soil and onion plants.]** *Khim. Sel'sk. Khoz.* 19(6): 54-56; 1981 (14 references) (Russian).

Ramrod (propachlor), mesoranil (aziprotryne), metazin and linuron concentrations in soil were determined following application of these pesticides to onion plant. The concentrations detected in soil depended on time of application, chemical composition, and dose of preparation, as well as depth of sampling and weather conditions. These pesticides accumulated in onion plants to varying degrees. Ramrod (4-7 kg/ha), mesoranil (1.5-3 kg/ha), metazin (1.2 kg/ha), and linuron (1.5-3 kg/ha) were applied once to onions on soddy-podzolic, weakly podzolized, medium-loamy soil in the Belorussian SSR. At the end of the vegetation period they were not detected in soil.

81-3113. Hesse, V.; Gabrio, T.; Kirst, E.; Plenert, W. (Univ. Kinderklin., DDR-6900 Jena, DDR) **Untersuchungen zur Kontamination von Frauenmilch, Kuhmilch und Butter in der DDR mit chlorierten Kohlenwasserstoffen. [Studies on the contamination of human milk, cow milk and butter with chlorinated hydrocarbons in the DDR.]** *Kinderuerztl. Prax.* 49(6): 292-309; 1981 (60 references) (German).

DDT, HCH (BHC), hexachlorobenzene (HCB) and PCB residues were determined by thin layer chromatography (TLC) and gas chromatography of 350 samples of butter, 70 samples of cow milk, and 227 samples of human milk collected from different parts of the DDR from 1975 to 1978. In the course of this time period residues in butter decreased from 0.24 to 0.14 mg/kg DDT, and from 0.0740 to 0.03 mg/kg HCH. Levels in cow milk decreased from 0.52 to 0.24 mg/kg DDT, and from 0.12 to 0.08 mg/kg HCH. In DDR, the maximum permissible level for DDT in butter is 1 mg/kg fat, for HCH 0.5 mg/kg fat, and for HCB 0.5 mg/kg fat. ΣDDT and ΣHCB contents in human milk samples collected in 13 DDR towns exceeded the limit [ΣDDT 2.7 mg/kg fat (1.0 mg/kg fat norm); HBC 0.81 mg/kg (0.5 mg/kg fat norm)]. Human milk had higher HCH, HCB, and DDT residues than cow milk by coefficients of 3.3, 10.6 and 12.2, respectively.

81-3114. Yamaguchi, M.; Noda, H.; Yamada, T.; Mitsukuni, Y.; Doi, S.; Sugiyama, S.; Yoshimura, M. (Sch. Legal Med., Fac. Med., Kinki Univ., Sayama, Osaka, Japan) **[Studies of organochlorine pesticides in human organs and tissues(IV) – comparison of BHC concentration in adult human fat tissue and liver in 1974 and 1979.]** *Kinki Daigaku Igaku Zasshi (Med. J. Kinki Univ.)* 6(1): 25-33; 1981 (9 references) (Japanese).

Concentrations of BHC in adult human adipose tissue (32 specimens) and liver (30 specimens) obtained from autopsy cases in Osaka Prefecture in 1979 were determined. In the adipose tissue, the highest concentration, the lowest concentration, and the mean value of ΣBHC were 24.608, 1.265, and 9.832 μg/g (fat base), respectively. These data were higher than the data in 1974. α and γ (lindane) isomers especially showed significant increases in accumulated concentration. The percentages of α and γ isomers of the ΣBHC were 1.0 and 98.0, respectively, showing the same percentage as in 1974. In the livers, the highest, the lowest, and the mean concentrations of ΣBHC were 23.912, 0.644, and 7.195 μg/g (fat basis), respectively; the 3 data were higher than the data in 1974. The accumulated concentration of α and γ BHC showed an especially significant increase. The percentages of α and γ BHC of ΣBHC were 1.7 (higher than that in 1974) and 96.9 (lower than that in 1974), respectively. The data show that, although it is 10 yr since BHC has been banned, the accumulation of BHC in the human body through consumption of contaminated foods is still in progress.

81-3115. Stout, V. F.; Houle, C. R.; Beezhold, F. L. (Utilization Res. Div., Northwest & Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA 98112) **A survey of chlorinated hydrocarbon residues in menhaden fishery products.** *Mar. Fish. Rev.* 43(3): 1-13; 1981 (22 references).

Menhaden (*Brevoortia tyrannus* and *B. patronus*) contributes indirectly to the human diet through use of menhaden products in animals feed. DDT, PCB, dieldrin, and endrin content of whole menhaden and menhaden reduction products were determined in samples taken in the period 1969-1977 from all areas of the U.S. menhaden fishery: 610 samples were analyzed for ΣDDT, DDT, DDE, and TDE; 314 samples were analyzed for PCBs; and 253 samples were analyzed for dieldrin and endrin. The highest values and the arithmetic means for these compounds decreased in most samples over the period studied. Further statistical analysis of data on menhaden oil, using the F-test and Scheffe's method for multiple comparison (s-method), did not always confirm the hypothesis that levels of chlorinated hydrocarbons decreased with time. A number of factors were suggested as contributing to this discrepancy, including variations in the levels of oils found in some samples, variations in the number of samples tested for year to year, and population characteristics of menhaden.

81-3116. Basturk, O.; Dogan, M.; Salihoglu, I.; Balkas, T. I. (M.E.T.U. Mar. Sci. Dep., Erdemli, Icel, Turkey) **DDT, DDE, and PCB residues in fish, crustaceans and sediments from the eastern Mediterranean coast of Turkey.** *Mar. Pollut. Bull.* 11(7): 191-195; 1980 (21 references).

Organochlorine residues (chlorinated pesticides and polychlorinated biphenyls) were analyzed in marine organisms caught on the eastern Mediterranean coast of Turkey. Species collected were grey mullet, red mullet, striped mullet, and gold bandgoat fish, as well as shrimp and limpet. Sediment samples were collected with a grab

sampler. The levels of DDT, DDE, and PCB were determined by gas/liquid chromatography using an electron-capture detector. There was no appreciable amount of PCB in any of the species analyzed, except limpet, which showed up to 39 ng/g (fresh wt) of PCBs. PCBs were also very low in sediments. The DDT levels were much higher, with average *t*-DDT levels ranging from 5 ng/g in limpet to 130 ng/g in striped mullet. Average *t*-l-DDE concentrations ranged from 2 ng/g in limpet to 62 ng/g in striped mullet. The *t*-DDT levels in sediments were 3-21 ng/g, while *t*-DDE levels in sediments were 2-8 ng/g. The *t*-DDT levels found were similar to those found in other parts of the Mediterranean basin, but higher than those reported in the Atlantic Ocean. A linear correlation was found between the organochlorine residue concentrations and the extractable organic material of the samples.

81-3117. Ehrhardt, M. (Inst. Meereskunde, Kiel, BRD) **Organic substances in the Baltic Sea.** *Mar. Pollut. Bull.* 12(6): 210-213; 1981 (29 references).

Pollution of the Baltic Sea by mineral oil (fossil hydrocarbons), chlorinated hydrocarbon pesticides, and PCBs, is reviewed. DDT levels reported in the Baltic ranged from 0.03 to 6.85 ng/l. DDE levels ranged from 0.03 to 5.2 ng/l. DDD (TDE) levels ranged from 0.02 to 3.4 ng/l. The difficulties of assessing the hazards of these compounds to Baltic biota are discussed.

81-3118. Lokke, H.; Odgaard, P. (Lab. Environ. Sci. & Ecol., Tech. Univ. Denmark, DK-2800 Lyngby, Denmark) **Residues in blackcurrants, fodder peas, spinach and potatoes treated with sublethal doses of 2,4,5-T to simulate wind drift damage.** *Pestic. Sci.* 12(4): 375-384; 1981 (13 references).

Blackcurrants, treated with 0.1 kg of 2,4,5-T/ha (as esters of mixed C_4-C_8 alcohols; Tormona 80), contained 0.1 mg of 2,4,5-T residues/kg in the berries at ripeness 29 days after treatment. Total residues in the berries were not reduced during growth and ripening, although the residue concentrations declined in the same period due to growth dilution. In spinach leaves from old plants, treated with 0.1 kg/ha, 0.05 mg of 2,4,5-T/kg was found 14 days after treatment. Fodder peas showed no residues (< 0.002 mg/kg) at harvest 62 days after treatment with 2,4,5-T esters. After application of 0.1 kg/ha on potato plants, the disappearance of 2,4,5-T was rapid during the first month, but residues were translocated into the tubers and reached a constant level of 0.02 mg/kg after 1 mo until harvest at 108 days after treatment. In all crops, visible effects were observed after treatment with 0.1 kg/ha. After the application at 0.01 kg/ha, phytotoxic effects were observed only in blackcurrants, but negligible residues were found in all the test crops. (Author abstract by permission)

81-3119. Anonymous **Pesticides may not persist in the tropics.** *Science* 213(4513): 1238; 1981.

Evidence is presented which indicates that results from experiments on DDT breakdown in the United States and other temperate regions may not be applicable to the tropics. Tests on DDT and 4 other pesticides have shown that they are broken down much more rapidly in tropical and subtropical climates. The pesticides were applied in the field at twice the normal rates: 5 kg/ha for DDT and dieldrin and 10 kg/ha for fonofos, phorate, and carbofuran. When residues were analyzed in the top 15 cm of soil, it was seen that the pesticide accumulated during the winter months after the fall application, but broke down rapidly during the summer months. Thus, the half-life of DDT is found to be < 6 mo in the tropics, compared with a half-life reported in terms of yr in the temperate zone.

81-3120. Hance, R. J.; Byast, T. H.; Smith, P. D. (Agric. Res. Counc., Weed Res. Org., Begbroke Hill, Yarnton, Oxford OX5 1PF, England) **Apparent decomposition of paraquat in soil.** *Soil Biol. Biochem.* 12(4): 447-448; 1980 (3 references).

A field experiment was begun in 1967 to test the behavior of paraquat added to soils. Up to 1973, paraquat levels were still at about 100% of the applied paraquat, suggesting that paraquat was unavailable for plants and other organisms. As of 1978, some of the paraquat had disappeared. The basic decay process followed a reaction rate that approaches first order. An annual rate of loss of ~ 10% was observed which produced a half-life of ~ 6.6 yr. The possibility of errors in the pre-1973 data collection scheme is briefly discussed. Studies of the adsorption of paraquat indicate that it was improbable that the compound was leached. Photolytic degradation is possible, although the results do not suggest that it occurred to a significant extent. It was concluded that paraquat present in quantities below the strong adsorption capacity of the soil is either progressively bound by a mechanism that survives the analytical procedure, which involves digestion of the soil with sulfuric acid, or it is degraded.

81-3121. Miller, W. M.; Ismail, M. A.; Craig, J. O. (Univ. Florida, Winter Haven, FL) **Disposition and air dispersal of ethylene dibromide from fumigated citrus.** *Trans. ASAE* 24(4): 1050-1057; 1981 (21 references).

Studies were conducted to determine the disposition of ethylene dibromide (EDB) during fumigation of citrus fruits. Air samples were taken 50, 100, and 200 m downwind of the fumigation processing center. A mass balance was determined by analyzing air samples, fiberboard cartons, and fumigated grapefruit. It appears that 81% of the applied dose was expelled to the atmosphere. Adsorption by cartons accounted for 9.4% and grapefruit accounted for 6.4%. A Gaussian distribution model overestimated atmospheric levels, but the model was

thought to provide an adequate upper bound estimate for workers exposed to the fumigant.

81-3122. Chladek, Z. (Cent. Inst. Control & Tests Agric., Brno, Czechoslovakia) **Problems of droplet drift by low-volume spraying.** In: *Trends in Airborne Equipment for Agriculture and Other Areas.* (Pergamon Press Ltd: Oxford): pp. 291-296; 1980 (8 references).

Studies on the problems of drift during low volume spraying are described. Possible control of initial size of droplets and the determination of optimum conditions for the sedimentation of droplets are considered. Tests were carried out in the laboratory, at airports and under field conditions. Optimum droplet size was attained with Teejet nozzles with Sabatka's terminals. Tests on those preparations which may change the physical properties of the pesticides being sprayed indicated that better results were obtained with antievaporants than with regulators of viscosity; wetting agents show no significant effect on initial size of droplets. Proper operation of spraying equipment and proper flight path was also found to considerably reduce droplet drift.

81-3123. Hollo, A.; Desi, I.; Gonczi, L.; Pasztor, S. (Dep. Toxicol., Natl. Inst. Hyg., Budapest, Hungary) **Studies on malathion pollution in the air after mosquito control in two areas of Hungary.** In: *Trends in Airborne Equipment for Agriculture and Other Areas.* (Pergamon Press Ltd: Oxford): pp. 355-358; 1980 (10 references).

Air samples were collected in 2 areas of Hungary (the shore area of Lake Balaton and the riverside area of the Danube) following spraying of 90% malathion for mosquito control. Samples were collected between 0-30, 30-120, and 120-240 min after spraying. The air samples flowed through active charcoal and into glass tubes; malathion contents were trapped on the adsorbent. The adsorbed malathion was dissolved in dichloromethane, then analyzed by a gas chromatographic method. Malathion air levels were found to be higher at Lake Balaton (ranging up to 839 $\mu g/m^3$ after 30 min) than on the Danube, possibly because of the abundant vegetation along the Danube. All levels determined were several orders of magnitude lower than the standard established for malathion in the work place. It is concluded that no danger to the environment or the population of the area is posed by spraying malathion for mosquito control.

81-3124. Seth, T. D.; Kaphalia, B. S. (Ind. Toxicol. Res. Cent., Lucknow 226001, India) **1,2,3,4,5,6-Hexachlorocyclohexane (HCH) residues in tissues of sheep.** *Vet. Hum. Toxicol.* 23(4): 247-248; 1981 (13 references).

Forty-five samples of body fat, skeletal muscle, and blood plasma were collected from different slaughter houses around the city of Sprinagar, India in August of 1980. HCH (BHC) levels were low; all values reported in sheep tissues were within the 2-ppm tolerance limit. The major meat supply for this part of India is sheep from Rajasthan, West India. α-HCH (α-BHC) and γ-HCH (lindane) were detected in all samples. Traces of β-HCH (β-BHC) were detected in blood plasma; β HCH was found primarily in samples of fat and skeletal muscle. HCH concentrations were relatively high in blood plasma and body fat of local sheep compared to Rajasthani sheep. Values were comparable in skeletal muscle. Accumulation of lindane was maximum in adipose tissue, liver, and kidney. The maximum number of samples were found to contain residues of 0.05-0.1 ppm in skeletal muscle and > 0.2 ppm in body fat samples. The blood plasma contained residues < 0.05 ppm in all samples. These findings suggest that the residues detected would be no risk to human health.

81-3125. Wegman, R. C. C.; Greve, P. A.; DeHeer, H.; Hamaker, P. (Unit Residue Anal., Natl Inst. Public Health, 3720 BA Bilthoven, The Netherlands) **Methyl bromide and bromide-ion in drainage water after leaching of glasshouse soils.** *Water Air Soil Pollut.* 16(1): 1-11; 1981 (11 references).

Studies were conducted to determine the concentrations of methyl bromide and bromide-ion in irrigation, drainage and surface waters of glasshouse soils fumigated with methyl bromide. Soils of 2 glasshouses were treated with 70-100 g/m^2 methyl bromide. Following treatment, the soils were irrigated, during which time water samples were collected and analyzed by gas chromatography. The highest concentration of methyl bromide observed was about 9 g/m^3. The highest concentration of bromide ion was 72 g/m^3. A fish kill was observed in the drainage ditch of one of the study sites. Studies indicated that the average half-life of methyl bromide in surface water under the conditions of this study was 6.6 hr.

81-3126. Rebhun, M.; Manka, J. (Environ. & Water Resour. Eng. Tech., Israel Inst. Technol., Haifa, Israel) **Organic micropollution indices of effluents and renovated waters.** *Water Res.* 15(7): 789-801; 1981 (15 references).

Secondary and tertiary effluents from wastewater treatment systems were examined to determine the solvent-extractable organics present in them. These organics represent organic micropollutants. Characterization methods used in the study included the gravimetric determination of total solvent-extractables, gravimetric determination of extractables in solvents of various polarities, fractionation of extractables by column chromatography followed by solvent elution in ascending polarity, and gas-chromatographic fingerprinting of specific solvent ex-

tracts. The concentration of organics by these methods may serve as an indicator of organic microcontamination, and thus indicate the toxicological quality of effluents and renovated waters. Benzene followed by chloroform, or the use of diethyl ether as a single solvent, obtained the highest recoveries of solvent-extractable organics. The polar fraction in secondary effluents accounted for about 45% and the non-polar for about 32%. Removal of the total electron capture detector responding compounds was about 69%, which was very close to the total solvent-extractable organics removal. Lindane and aldrin were the most frequently found chlorinated pesticides. Average concentrations were ~ 0.3 μg/l in oxidation pond effluents, ~ 0.1 μg/l in lime clarifier effluents, and ~ 0.03 μg/l in after-lime polishing ponds. The extent of removal of these compounds in a controlled, advanced-treatment system was investigated. Oxidation pond effluent samples were spiked to concentrations of 4 μg lindane and 2.5 μg aldrin/l effluent. Samples were then lime flocculated and held for 10 days in a rectangular tray to simulate lime clarifier and after-lime polishing pond treatment. Removal after lime flocculation was 74.0% for lindane and 97.5% for aldrin. After lime flocculation and detention removal was 97.4% for lindane and 100% for aldrin. The GC-ECD fingerprints for the benzene extractables from these spiked effluents are also presented.

See also 81-3003, 81-3008, 81-3009, 81-3010, 81-3011, 81-3017, 81-3025, 81-3032, 81-3036, 81-3071, 81-3072, 81-3073, 81-3078, 81-3141, 81-3153, 81-3155, 81-3192, 81-3245, 81-3257, 81-3275, 81-3285, 81-3292, 81-3293 *and* 81-3300.

81-3127. Palshaw, M. W. (Stauffer Chem. Co., Westport, CT 06880) **The contribution of epidemiology.** *ACS Symp. Ser.* 160(CH09): 157-169; 1981 (6 references).

The role of epidemiological studies in evaluating human health effects that may be related to pesticide exposure is examined. Epidemiology is defined. A historical review of the discipline and an overview of occupational epidemiological studies are presented. Occupational epidemiological studies often enlist the aid of chemists, chemical engineers, industrial hygienists, toxicologists, physicians and biostatisticians. Basically, epidemiological studies may be subdivided into morbidity and mortality studies. Surveillance of workers encompasses physical examinations, work-related illnesses, and biological monitoring of cholinesterase to detect over-exposure to organophosphorus and carbamate pesticides. Selected epidemiological studies related to pesticide exposure are briefly reviewed and ongoing and new research programs are outlined. Epidemiology will play a key role in government and employer programs designed to safeguard the health of workers.

81-3128. Neal, R. A. (Cent. Toxicol., Dep. Biochem., Vanderbilt Univ. Sch. Med., Nashville, TN 37232) **Risk benefit analysis: role in regulation of pesticide registration.** *ACS Symp. Ser.* 160(CH28): 469-472; 1981.

Pesticide regulators must make judgements about the marketability of products that may cause adverse health effects in man. To decide whether or not to register a pesticide, the regulators must know its potency, the potential risk to humans if exposed to the chemical, and the degree of reversibility of its toxic effects. The regulator may act to ban the pesticide or to restrict its use or methods of application. The economic benefits of a pesticide and the political climate at the time of its consideration are also factors that affect the registration process. The ability of an experienced and objective toxicologist to arrive at a correct assessment of the potential risk to man from exposure to a pesticide is an important factor in the process of risk-benefit analysis.

81-3129. Warren, J. M. (Environ. Def. Fund, New York, NY 10016) **An environmentalist's view of toxicology and pesticide regulation.** *ACS Symp. Ser.* 160(29): 473-477; 1981 (2 references).

The Environmental Defense Fund (EDF) is concerned with human involuntary exposure to hazardous compounds, particularly pesticides, through the food chain. The US EPA has been given the power to register pesticides, but the registrants must first weigh the risk-benefit ratio of each chemical. Many persistent, highly toxic and/or carcinogenic pesticides have already been removed from the market. To perform statutory risk-benefit balancing mandated by the Federal Insecticide, Fungicide, and Rodenticide Act, the EPA must have the most complete knowledge available about each compound. The EPA has proposed *Good Laboratory Practice Guidelines for Toxicology Testing* as recommended protocol for all analytical laboratories. Limitations of previously submitted laboratory data for purposes of pesticide registration are discussed, and the future responsibilities of scientists in analytical laboratories are considered.

81-3130. Emmerson, J. L. (Lilly Res. Lab., Eli Lilly & Co., Greenfield, IN 46140) **Industrial view of toxicology and pesticide regulation.** *ACS Symp. Ser.* 160(CH30): 479-491; 1981.

The state of pesticide regulations is presented, with a review of the historical processes leading up to restrictions on these chemicals and an outlook to the future of the field. The 1972 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act are outlined, and the scope of the regulatory task is discussed. The testing regimes required for various types of toxicology studies are listed, and some of the changes brought about by the 1975 EPA regulations are considered. The new regulations have generally slowed the registration procedure considerably and many pesticides have been suspend completely. The author presents a list of recommendations. To speed up the evaluation of candidate chemicals for registration, it is recommended that the EPA use certified summaries of toxicological data, clarify the aims of the EPA *Good Laboratory Practice* program, modify current proposed toxicology guidelines, and acquire a stable, authoritative body of scientific personnel.

81-3131. Johnson, E. L. (Off. Pestic. Programs, US EPA, Washington, DC 20460) **Pesticide regulation: toxicology and risk evaluation.** *ACS Symp. Ser.* 160(CH32): 503-511; 1981 (1 reference).

The EPA is charged with the task of determining the risks involved when the public is exposed to pesticides, and evaluating the risks in light of the benefits that the use of a particular chemical may provide. The Federal Insecticide, Fungicide and Rodenticide Act deals with this risk/benefit analysis. The present program for pesticide registration requires the registrant to give information on the chemical composition of the product, biological test data on acute and chronic effects, and test data on equivalent risk indices for fish and wildlife. Hazard assessment is often aided by epidemiological data; it is suggested that this should not be the case, since effects should be known before a population is exposed to a pesticide. The EPA has made use of quantitative risk assessment procedures in deciding on regulations for carcinogenic pesticides. The role of short-term tests in toxicology studies is considered along with some suggestions for making better risk/benefit assessment.

81-3132. Dubach, P. (Ciba-Geigy Ltd., Basel, Switzerland) **Pesticide regulation in Europe.** *ACS Symp. Ser.* 160(CH33): 513-521; 1981 (6 references).

European policies on pesticide registration are reviewed. The US and many European countries have similar regulations regarding the use of pesticides. Some differences may be found in the interpretation of the laws, guidelines and requirements and in the political influences on regulation. A centralized pesticide registration scheme for the European Economic Community may not be established for some time; however, initial regulatory actions by individual nations may speed up the decision-making process in other countries. Many European nations are actively cooperating in the OECD efforts to coordinate the testing of chemicals. Most European delegates will be active in trying to secure optimal flexibility of upcoming laboratory guidelines for pesticide toxicity testing. It is hoped that experience in integrated human and environmental safety testing will make it possible to reach the right decision on a smaller amount of relevant data.

81-3133. Li, Z. M. (Res. Inst. Elemento-Organic Chem., Nankai Univ., Tianjin, People's Republic of China) **Pesticide chemistry and regulation in the People's Republic of China.** *ACS Symp. Ser.* 160(CH34): 523-535; 1981 (28 references).

The regulation of pesticides in the People's Republic of China is briefly reviewed. Some of the major pests and pesticides of this country are listed, and the development of pesticide chemistry in this nation is outlined. In 1974, when chlordimeform was found to be carcinogenic, the use of this insecticide to control rice paddy borers in China was stopped. Since then the use of many other compounds has been regulated under Regulations for Pesticide Management. These regulations consist of laws for processing applications for registration, measures for quality control and rules for safe application. The steps involved in the registration of a candidate pesticide are reviewed. Future trends in China will call for the development of more active, selective and biodegradable chemicals to handle pest problems.

81-3134. Clegg, D. J. (Toxicol. Eval. Div., Food Dir., Health Prot. Branch, Health & Welfare Canada, Ottawa, Ontario K1A OL2, Canada) **Pesticide regulation in Canada.** *ACS Symp. Ser.* 160(CH35): 537-544; 1981.

Pesticides in Canada are regulated under the Pest Control Products Act and the Food and Drugs Act, along with other acts addressing the quality of water, fisheries, wildlife and the environment. These acts generally place the onus on petitioners to submit toxicology data to support the safety of their candidate for registration. Great changes have taken place in the type of toxicity data requested over the past 30 yr. Some trends seen in Canada in classifying pesticides according to their toxicity are reviewed. Use of the negligible daily intake (NDI) and theoretical daily intake (TDI) concepts are discussed in relation to human exposure to pesticides. Potentiation studies for organophosphate insecticides were requested in the 1960's and 70's. In 1978, an advisory group was formed to help Agriculture Canada evaluate toxicity data. The US and Canadian toxicity tests differ mainly in the length of testing required. Many organochlorine compounds, lead arsenate, EBDC, and leptophos have been banned from use as pesticides in Canada, while levels of contaminants in other compounds have been regulated. It is expected that in the future the minimal requirements for toxicological data to register pesticides in Canada will increase.

81-3135. Kearney, P. C. (USDA, Beltsville, MD 20705) **Regulatory aspects: a summary.** *ACS Symp. Ser.* 160(CH36): 545-549; 1981.

Many interest groups have used toxicological data to force regulatory agencies to develop more sophisticated methods of risk/benefit assessment. Some of the public forces influencing the regulation of pesticides are examined, and regulations in various countries are reviewed. Recent changes being implemented in the regulation of pesticides are discussed. Many compounds have been banned from use. Industry has recommended some procedures to speed pesticide registration. The activities of the Environmental Defense Fund and consumer groups in pesticide regulatory processes are considered. Studies used in assessing risks to humans are outlined. Pesticide registration protocol in Europe is similar to that of the United States. The registration and regulation of pesticides in Canada and the People's Republic of China are also considered.

81-3136. Rice, D. (Colorado Dep. Health, Denver, CO 80220) **Colorado court involvement in chemical spill clean-up activities.** *Am. J. Public Health* 71(9): 1044-1045; 1981.

In December 1977 a fire at a pesticide formulation and storage facility in Colorado spread partially combusted pesticides over a large area surrounding the pesticide facility, leaving a thick coating of chemicals on the building supports. Soil samples taken in the area showed dangerously high levels of parathion, methyl parathion, DDT, DDE, dieldrin, endrin, lindane, methoxychlor, 2,4-D, malathion, chlordane, and toxaphene. In June of the following year, the State filed an action to force Colorado International Corporation, which operated the facility, to detoxify the area. Tests had indicated that groundwater contamination had already occurred to some degree from the leaching of pesticides through sandy soil. By mid-August about 1.6 million lb of soil were scraped and removed to a landfill, but high levels of contamination still remained. Clean-up of the area was completed by February of 1979, 14 mo after the fire. In the fall of 1979, the stabilization and covering of the landfill was completed. The author concludes that

the legal system is not a highly satisfactory means of achieving action in situations that pose such immediate health hazards.

81-3137. Richardson, W. H. (Alvord, Burdick & Howson, Chicago, IL) Experience gained with the U.S. pollution control policies. *Aqua* (2): 245-255; 1981 (25 references).

Pollution control policies in the United States from the late 1800s to the present are reviewed. The current status of water pollution control systems is noted, along with benefits that stem from pollution control policies. These benefits include a reduction in pollution, a transfer of technologies, public works programs, and the establishment of water quality standards. Negative aspects of the pollution control program include excessive government regulation, loss of local control, time delays, inflation, large projects and expensive treatment methods, and operating and maintenance expenses. Other federal activities that attempt to control water pollution include the passage of the Federal Insecticide, Fungicide and Rodenticide Act to protect the environment and humans against adverse effects of manufacture and use of insecticides.

81-3138. Nehez, M.; Berencsi, G.; Selypes, A.; Csanko, J.; Levay, S.; Maurer, J.; Nagy, E.; Czeizel, E.; Szentesi, I. (Inst. Public Health Epidemiol., Szeged Med. Univ., Szeged, Hungary) Agrokemizalok epidemiologiai adatai, kulonos tekintettel a cytogenetikara. [Epidemiological data of persons working with agrochemicals, with special regard to cytogenetics.] *Egeszsegtudomany* 25(2): 129-137; 1981 (23 references) (Hungarian).

Chromosome analyses were performed in leukocytes from 109 men working with farm chemicals and from 57 normal unexposed men. The majority of the probands were < 49 yr old. The modified technique of Moorhead was used. Following ASG band staining, the chromosome alterations were evaluated according to the Edinburgh classification. The cholinesterase activity was found inhibited in 32 of 109 workers and 2 of 57 controls. Aberrant cells were found in 97 of 109 workers (88.9%) and in 68.42% of the controls. Aberrations were found in 6.57% of 1111 cells from the controls; 249 aberrations were found in 238 of 2146 cells from the workers (11.60%). The frequency of aberrations reached the significance limit after a length of employment of 1 yr. The frequency of numerical and all chromatid type aberrations was also increased among the workers, compared with the controls. The frequency was highest at a length of employment of 2-5 yr. The frequency of chromosome type aberrations was highest after 2-20 yr of employment. In the workers with inhibited cholinesterase activity there was a significant difference from the controls in the frequency of breaks and chromosome type aberrations. The findings indicate that the possibility of mutagenic effects in workers exposed to farm chemicals can not be excluded.

81-3139. Strier, M. P. (US EPA, Washington, DC 20460) Pollutant treatability: a molecular engineering approach. *Environ. Sci. Technol.* 14(1): 29-31; 1979.

A description is presented of the use of the molecular engineering approach to develop a separate treatment model for individual organic compounds designated by the US EPA as priority pollutants. Studies are being carried out to determine the best available technology economically achievable effluent limitations guidelines for 129 priority pollutants; the application of a molecular engineering approach is a supplemental study. Five unit treatment processes were investigated, and, based on physical-chemical properties and biochemical oxidizability, each pollutant was rated according to how well it would be expected to perform with each of the 5 processes. Effluent limitations were estimated. Priority pollutants capable of treatment to 1.0, 1-10, 10, 25, 50 and 100-1000 μg/l are listed. Solubilities were directly related to estimated theoretical effluent limitations, while partition coefficients and bioconcentration factors were inversely related. The thermodynamic relationships between these factors can also be used to evaluate efficiencies of operational treatment systems for the removal of organic priority pollutants.

81-3140. McKercher, S. R. (Entomol. Dep., Texas A&M Univ., College Station, TX) Pesticide regulation: measuring the residue. *Environment* 22(7): 6-13; 1980 (16 references).

The establishment of tolerance levels and allowable daily intake levels (ADIs) for individual pesticides in food is discussed. It is suggested that several major problems related to pesticide exposure are not accounted for. Two segments of the population at increased risk under the accepted exposure levels are infants and the elderly. In both cases, their diets are less varied, and their bodies less able to detoxify toxic materials. Tolerance levels proposed for various pesticides (captan, carbaryl, chlordane, coumaphos, ΣDDT, diazinon, dieldrin, heptachlor, lindane, malathion, parathion, and pyrethrins) in specific commodities are presented in tabular form. The cumulative intake of a pesticide or a group of pesticides that affect the body in a similar way, based on total food intake, is one parameter that should not be overlooked in setting standards for pesticide levels in foods. The enforcement of limits by means of a monitoring program has failed. In a program of this type in California, sampling procedures did not produce statistically valid data, publication of the data was obscure and of little value, and no attempt was made to use the data as a basis for action by the California Department of Food and Agriculture.

81-3141. Kawai, M.; Yoshida, M. (Lab. Hyg., Kagawa Women's Coll. Nutr. Takamatsu, Kagawa, Japan) [Exposure of spray operators to paraquat.] *Nippon Koshu Eisei Zasshi (Jpn. J. Public Health)* 28(7): 353-359; 1981 (8 references) (Japanese).

A 24% paraquat herbicidal preparation was diluted 300 times by volume with water, and the diluted solution was sprayed onto weedy ground for 2 hr with a power sprayer by a conventional method. Spray operators and assistants did not report any irritation on their eyes and skin due to paraquat. To examine the operators' systemic absorption of paraquat, the concentration of paraquat in urine collected during 24 hr after spraying was determined. In the urine of the operators who had worn a mask of gauze or non-woven fabric, 1.4 to 2.7 μg paraquat were detected. In the urine of the operators who had worn a high-performance mask, no paraquat was detected. During the spraying operation, the concentration of paraquat in the air near the operator's mouth was 11-33 μg/m³ About 51 mg of paraquat is estimated to have adhered to the operator's protective clothing, mostly to that covering the lower half of the operator's body. The total dermal exposure for an operator wearing a protective long-sleeve shirt, trousers, rubber gloves, boots, and a mask was calculated to be about 0.22 mg. From these results, it is concluded that in practical operation of spray, there exists very little danger from paraquat as long as the protection of the operator is complete. However, it is recommended that spraying for a long period be avoided, that protective gear be worn to minimize skin contact, and that a high-performance mask be worn to avoid inhalation of paraquat.

81-3142. Patten, R. C. (Troutville, VA 24175) **Occupational diseases of the American farmer.** *Va Med.* 108(5): 339-341, 296; 1981 (6 references).

The American farmer is at higher risk than others for leukemia, skin tumors, and trauma. The American farmer today is exposed to many physical agents not encountered by his predecessors. Although organochlorines such as DDT have been taken off the market, a profusion of bug and weed killers remains. The most dangerous of these are the organophosphates and the carbamates. These can be taken into the organism by ingestion, inhalation, or surface absorption. Once in the body, they inhibit cholinesterase, allowing a toxic buildup of acetylcholine, resulting in a massive over-stimulation of the parasympathetic nervous system, excitation of skeletal muscles, and stimulation followed by depression of the central nervous system. Herbicides toxic to man include nitrophenols, chlorophenoxy compounds, arsenicals, dipyridyl compounds, and organonitrogens. Fungicides, fumigants, and rodenticides commmonly used on the farm and hazardous to man include vacor (pyriminil) and methyl bromide.

81-3143. Hopes Consulting Inc., Aberdeen, MD 21001 **An investigation of the possible effects of pesticide exposures on reproductive mortality and morbidity.** *World Agric. Aviat.* 7(12): 12, 14, 16, 30, 32-34; 1980 (4 references).

An epidemiological study was carried out in an effort to determine whether agricultural pilots in the United States show any effects on reproduction due to pesticides. Two populations were studied: the agricultural pilots and their spouses, and a like population of their siblings. Analyses showed the 2 populations to be reasonably homogeneous with regard to age, education, ht and wt. No regional or population differences were found using chi square analysis. Information was collected by questionnaire on live births, miscarriages and stillbirths, and on birth defects. The data concerning the health, life style habits and other factors reported by the participants have not yet been analyzed. However, it is suggested from these preliminary data that the only apparent difference is a slightly higher incidence of morbidity and mortality among the siblings.

See also 81-3001, 81-3017, 81-3018, 81-3019, 81-3035, 81-3037, 81-3038, 81-3039, 81-3040, 81-3066, 81-3078, 81-3084, 81-3098, 81-3099, 81-3106, 81-3121, 81-3122, 81-3126, 81-3145, 81-3148, 81-3149, 81-3154, 81-3155, 81-3242, 81-3245, 81-3257, 81-3264 *and* 81-3292.

81-3144. Williams, G. M. (Naylor Dana Inst. Dis. Prev., Am. Health Found., Valhalla, NY 10595) **Epigenetic mechanisms of action of carcinogenic organochlorine pesticides.** *ACS Symp. Ser.* 160(CH05): 45-56; 1981 (45 references).

Studies that demonstrate a lack of genotoxic activity by carcinogenic organochlorine pesticides are reviewed. These compounds seem to work on the intercellular lipid layer of cell membranes by a process that differs from that of other tumorigenic agents such as phenobarbital, which alters the activity of membrane-associated enzymes. The organochlorine pesticides show cytotoxicity only at high concentrations. This is consistent with the probable accumulation of the compound in cell membranes precluding cell damage. The organochlorine cytotoxicity is reversible up to a point, an effect unlike genotoxic carcinogens. It is hypothesized that human exposure levels to organochlorines have been sufficiently low to resist the cytotoxic actions of these compounds. It is also suggested that exposed human populations lack the background of genetic alterations in the liver needed to give rise to neoplasms in response to a promoting agent. It was recommended that the carcinogenic risks from organochlorine pesticide exposure be reevaluated.

81-3145. Waters, M. D.; Nesnow, S.; Simmon, V. F.; Mitchell, A. D.; Jorgenson, T. A.; Valencia, R. (Genet. Toxicol. Div., Health Effects Res. Lab., US EPA, Research Triangle Park, NC 27711) **Pesticides: mutagenic and carcinogenic potential.** *ACS Symp. Ser.* 160(CH07): 89-113; 1981 (71 references).

Methods for evaluating the mutagenic and carcinogenic potential of pesticides are presented. Genetic and related biological effects may be assessed by short-term bioassays for gene mutation, chromosomal effects, and primary damage to DNA. Other cell culture bioassays allow the observation of chemical transformation of normal cells into cells that are tumorigenic in animals. A phased evaluation approach which allows cost-effective utilization of limited testing resources and protection of human health according to anticipated exposure is outlined. Tests on 38 pesticides are used to explain the rationale for the technique. Bioassays are grouped to emphasize detection, confirmation and hazard assessment in this priority order. Whole animal tests are used to confirm positive results of short-term tests. A core battery of tests is proposed to delineate probable negative results of short term bioassays.

81-3146. Wolkowski-Tyl, R. (Chem. Ind. Inst. Toxicol., Research Triangle Park, NC 27709) **Reproductive and teratogenic effects: no more thalidomides?** *ACS Symp. Ser.* 160(CH08): 115-155; 1981 (145 references).

A current definition of teratology is offered and the history of the discipline is outlined. The categories of human and animal teratogens are delineated; among the agents listed are pesticides, fungicides, herbicides, warfarin and PCB. Teratogenic susceptibility is thought to depend on the specificity and disposition of the agent and the specificity of the target. State-of-the-art teratological tests are reviewed, and new procedures, such as toxicokinetics and metabolism on maternal and fetal tissues, *in vitro* test systems, and postnatal evaluations, are discussed. The possibilities of extrapolating animal data to humans for the purpose of risk assessment are considered. The sensitivity of current teratology testing is summarized, and the limitations of new methods being developed to ensure the health of unborn children are evaluated.

81-3147. Ivie, G. W.; Bandal, S. K. (Vet. Toxicol. & Entomol. Res. Lab., Agric. Res., SEA, USDA, College Station, TX) **Metabolic aspects of pesticide toxicology.** *ACS Symp. Ser.* 160(CH16): 257-284; 1981 (42 references).

The role played by metabolism in the expression of pesticide toxicity is reviewed. Detoxification, activation, mutagenicity, carcinogenicity, and the formation of pesticide conjugates and bound residues are outlined and discussed in relation to their toxicological significance. The importance of metabolism studies in formulating more selective and effective pesticidal products is stressed, and the methodology used in such studies is examined. Some problems involved with the use of data from pesticide metabolism studies to gauge toxicological risks to man are considered.

81-3148. Wright, A. S. (Shell Toxicol. Lab., Shell Res. Ltd., Sittingbourne Res. Cent., Kent ME9 8AG, England) **New strategies in biochemical studies for pesticide toxicity.** *ACS Symp. Ser.* 160(CH17): 285-304; 1981 (31 references).

New models are described that permit extrapolation of results from mammalian toxicity tests to application in humans, for the purpose of assessing the risk of human exposure to pesticides. Some goals of biochemical toxicology experiments are reviewed, along with the nature of the intoxication mechanisms. The nature of chemical cellular target interactions and their magnitude are key determinants of pesticide toxicity. The extrapolative models for risk assessment may depend heavily on the dose received by the target. Some qualitative and quantitative approaches for estimating target dose are presented, and the analytical problems and limitations of these models are considered. A few experiments which have used the target dose approach in pesticide toxicology are discussed. Particular attention is given to *in vivo* and *in vitro* studies of the effect of dichlorvos on mammalian DNA.

81-3149. Waggoner, T. B. (Anal. Dev. Corp., Monument, CO 80132) **Problems and pitfalls in biochemical**

studies for pesticide toxicology. *ACS Symp. Ser.* 160(CH18): 305-321; 1981 (7 references).

Biochemical pesticide toxicity testing may take many forms depending on the system being considered. The aims of biochemical toxicity tests are basically to give pharmacokinetic data and to identify major pesticide metabolites and possibly reactive intermediates commonly found. Problems of biochemical toxicity tests are outlined. Extrapolation of results from one species to another is often difficult. Various *in vitro* and *in vivo* test systems are examined. Some problems with isotope labeling methods are considered. Traditionally, instability of pesticide metabolites has caused problems during isolation and storage. Little is known about the toxic effects of some excreted metabolites. Many organophosphorus pesticides, although excreted rapidly, are highly neurotoxic. Current studies on the fate of metabolites, organosoluble residues, water-soluble metabolites, insoluble residues, and reactive intermediates are reviewed, and the acceptance of this research by the scientific community is discussed.

81-3150. Cairns, T. (Dep. Health & Human Serv., Food & Drug Adm., Natl. Cent. Toxicol. Res., Jefferson, AR 72079) **The increased role of chemistry in toxicology.** *ACS Symp. Ser.* 160(CH21): 335-347; 1981 (8 references).

The widespread use of synthetic organic and inorganic chemicals, including pesticides and herbicides, in recent years has increased the importance of toxicological studies. The role of the modern analytical chemist in the field of toxicology is reviewed, along with present day duties practiced by these experts in the analysis of toxic substances. Good laboratory practices in nonclinical laboratory studies are discussed and include such factors as the control of trace substances in animal feeding tests, and the analysis of trace carcinogens in wastewater. The biochemical mechanisms of carcinogenesis are considered, and future trends in chemistry and toxicology are examined. At present there is no single multi-residue procedure that is capable of determining the entire spectrum of pesticide residues in a given sample.

81-3151. Dalela, R. C.; Rani, S.; Rani, S.; Verma, S. R. (Pollut. Relevant Res. Lab., Postgrad. Dep. Zool., D.A.V. Coll., Muzaffarnagar, India) **Influence of pH on the toxicity of phenol and its two derivatives pentachlorophenol and dinitrophenol to some fresh water teleosts.** *Acta Hydrochim. Hydrobiol.* 8(6): 623-629; 1980 (15 references).

Studies were conducted on the effect of pH on the toxicity of some phenolic compounds to fish. Specimens of the genera *Colisa*, *Saccobranchus*, and *Notopterus* were exposed to phenol, pentachlorophenol, and dinitrophenol over a range of concentrations to estimate LC50 and safe concentration values. Tests were repeated at 4 pH levels: 4.6, 6.0, 7.3 and 8.8. The increase in toxicity was none to slight when pH changed from 7.3 to 6.0 or from 7.3 to 8.8. However, a change in pH from 7.3 to 4.6 increased the toxicity of phenol, pentachlorophenol, and dinitrophenol 5.05, 19.3, and 22.33 times, respectively, for *Notopterus*; 3.59, 4.39 and 4.73 times for *Colisa*; and 3.04, 4.68 and 5.85 times for *Saccobromachus*. The study was in agreement with published reports on increased toxicity of pollutants at low pH, and low toxicity at high pH.

81-3152. Pietr, S. J. (Inst. Agric. Chem., Soil Sci. & Microbiol., Agric. Acad., 50-357 Wroclaw, Poland) **Herbicidal effect on some metabolic processes of *Azotobacter chroococcum*.** *Acta Microbiol. Pol.* 30(2): 173-182; 1981 (24 references).

Studies were conducted to determine the effects of Pyramin (chloridazon) and Venzar (lenacil) on growth, O_2 uptake, herbicide uptake, binding of herbicides by mucopolysaccharides, and nitrogenase activity of *Azotobacter chroococcum*. Cultures were exposed to 20 or 100 ppm Pyramin, 10 or 50 ppm Venzar, 20 + 10 ppm or 100 + 50 ppm Pyramin + Venzar. After 72 hr of incubation the cells were harvested and analyzed. Pyramin at 20 and 100 ppm stimulated growth and bound to mucopolysaccharides. Pyramin and Venzar reduced the acetylene reduction rate of crude extracts by 50%. Venzar was found to penetrate into cells. Although the Pyramin concentrations in the culture medium decreased, no evidence was seen for its penetration into cells.

81-3153. Simon-Sylvestre, G.; Fournier, J. C. (Dep. Soil Sci., Stn. Soil Sci., I.N.R.A., Versailles, France) **Effects of pesticides on the soil microflora.** *Adv. Agron.* 31: 1-92; 1979 (458 references).

The effects of pesticides on the soil microflora are discussed. An extensive bibliographic review of research carried out during the last 15 yr is presented. The methodology used in the study of pesticides and soil microflora is reviewed. Areas of discussion include the effects of pesticides on the microorganisms and on the total activity of the soil, the effects of pesticides on the biological cycles of the soil (carbon, nitrogen, sulfur, phosphorous, and manganese), action of pesticides on pathogenic microorganism, and effects of pesticides on the microflora responsible for pesticide degradation. For each topic, data are presented and conclusions drawn. It is pointed out that agricultural pesticides do affect soil microflora, especially pathogenic and decomposing microflora. Nitrification and cellulolysis cycles also appear to be affected by pesticides. Although the effects are generally limited at normal field rates and with short-term applications, the data presented indicate that more research is necessary before definite conclusions can be drawn.

81-3154. Pries, C. N. (St. Paul-Ramsey Med. Cent., St. Paul, MN) **Reproductive effects of occupational exposures.** *Am. Fam. Physician* 24(2): 161-165; 1981 (7 references).

While the normal woman with an uncomplicated pregnancy may continue to work in many cases until the onset of labor, there are certain environments in which a reevaluation of this attitude is advisable. Recognized hazards in the patient's workplace must be considered in the course of regular prenatal care. Among the known human reproductive toxins are pesticides. Exposure to carbaryl can result in reduced fertility. Chlorinated hydrocarbon exposure can cause mutagenesis. Exposure to Kepone (chlordecone) has been documented to produce reduced fertility in men. Dibromochloropropane also effects the reproductive system, but data concerning its effects are as yet incomplete.

81-3155. Holzer, G.; Oro, J. (Dep. Biophys. Sci. & Chem., Univ. Houston, Houston, TX 77004) **Chemical carcinogenesis: A natural and man-made global environmental problem.** In: *Analytical Techniques in Environmental Chemistry.* Albaiges, J., ed. (Pergamon Press: Oxford): 3: 211-236; 1980 (156 references).

Information on testing procedures and analysis of carcinogenic compounds in the environment is presented. Testing procedures include the bioassay and the use of bacterial mutants. Regulations that attempt to decrease the exposure of the population to carcinogens in the workplace and decrease the amount of these chemicals escaping to the environment are discussed. Major chemical groups whose individual members are known carcinogens include polycyclic aromatics, alkylating reagents, aromatic amines, and nitroso-compounds. Carcinogenic compounds present in polluted air, water, and food are also considered. Sources of organic materials in water include runoff or erosion contaminated with fertilizers, insecticides, pesticides, and soil chemicals. Analytical techniques for many of these potential carcinogens are presented.

81-3156. Aveling, C. (Garreg Wen', Bracken Close, Wonersh Park, Guildford, Surrey GU5 0QS, England) **Action of mephosfolan on anthocorid predators of *Phorodon-humuli*.** *Ann. Appl. Biol.* 97(2): 155-164; 1981 (23 references).

Soil drenches of mephosfolan were applied to hop plants in both glasshouse and field studies to control the aphid, *Phorodon humuli*, and to study the toxicity of this agent to anthocorid predators of the aphid. With increasing dosages of mephosfolan, mortality of *Anthocoris nemorum* and *A. nemoralis* eggs was increased. There appeared to be little effect, however, on *A. confuses* eggs, which were laid in the petioles and veins as opposed to being laid in the leaf tissues. *A. nemorum* eggs were laid in the leaf margins and exhibited higher susceptibility to mephosfolan than did *A. nemoralis* eggs, which were laid mainly in the interveinal areas. Mortality was highest for eggs laid in the leaf margins in both species. Mephosfolan may have become unevenly distributed within the leaves, being most concentrated in the leaf margins and least concentrated in the veins and petioles. Oviposition rates were not affected by various dosages of mephosfolan. Oviposition rates, larval mortality, and duration of larval development were not affected when specimens of each species were reared from eclosion to maturity on a diet of either mephosfolan-killed or heat-killed *P. humili*.

81-3157. Narain, A. S.; Srivastava, P. D. (Dep. Zool., Univ. Gorakhpur, India) **Haematohistological responses of the Indian freshwater catfish, *Heteropneustes fossilis* to environmental pollution by sewage, fertilisers, and insecticides.** *Arch. Biol.* 90(2): 141-159; 1979 (31 references).

The effects of long-term exposure to sewage, fertilizers and insecticides on the common Indian catfish, *Heteropneustes fossilis*, was studied. Fish were collected from unpolluted habitats, and after acclimatization were subjected for 40 days to sewage (25-100%); fertilizers; and the insecticides BHC (20% emulsion); Stardrin (AI 20% endrin); Nuvacron 40 CIBA (AI monocrotophos); and Dimecron 100 CIBA (AI phosphamidon; phosmet). Blood samples were obtained from the exposed fish, and blood cell anomalies recorded. Sewage was found to be the most toxic (due to high NH_3-H and Ca conditions) and insecticides the least toxic. Of the insecticides tested, monocrotophos was the most toxic, causing nuclear atrophy and eosinophilic smudges (identical in appearance to human smear cells) among leukocytes in 50-75% of the replications. BHC caused cytoplasmic inclusions among erythrocytes and phosphamidon caused eosinophilic smudges among leukocytes in 25-50% of the replicates. Other insecticide-induced anomalies (seen in < 25% of the replicates) included lysis, nuclear eccentricity, nuclear elongation, cytoplasmic vacuolization in erythrocytes, and vacuolization in leukocytes.

81-3158. Shri, N. G.; Hollinger, M. A.; Schiedt, M. J. (Dep. Physiol. Sci., Sch. Vet. Med., Univ. California, Davis, CA 95616) **The effects of paraquat and superoxide dismutase on pulmonary vascular permeability and edema in mice.** *Arch. Environ. Health* 36(4): 149-154; 1981 (42 references).

Intraperitoneal administration of 50 mg/kg paraquat dichloride to mice significantly increased pulmonary vascular permeability at 24 and 48 hr, as measured by ^{125}I-albumin content of alveolar lavage. Lung edema, measured by lung wt as % body wt, was significantly increased 48 hr after paraquat treatment. IV administration of 4 doses of superoxidase dismutase at 12-hr intervals (ie, 1 before and 3 after paraquat treatment) failed to inhibit

paraquat-induced increased pulmonary vascular permeability and pulmonary edema. Superoxide dismutase treatment also failed to reduce mortality and had no significant effect on the death time course in animals challenged with paraquat. The results of this study suggest that acute toxic effects of paraquat, such as increased pulmonary vascular permeability and pulmonary edema, may not be mediated through the generation of superoxide anion. (Author abstract by permission)

81-3159. Fairshter, R. D. (Dep. Med., Univ. California, Orange, CA 92668) **Paraquat toxicity and lipid peroxidation.** *Arch. Intern. Med.* 141(9): 1121-1123; 1981 (21 references).

Paraquat intoxication is associated with a high record of mortality when ingested or injected subcutaneously. Lung and kidney damage is clinically observed in paraquat poisoning, and is sometimes accompanied by renal failure. Severe obliterative pulmonary fibrosis is the most frequent cause of death in paraquat toxicity. Lung tissue actively accumulates paraquat; most therapeutic remedies are aimed at preventing paraquat absorption and accelerating paraquat excretion. Other attempts have been made to modify the tissue effects of absorbed, nonexcreted paraquat. Paraquat is thought to cause peroxidation of lipid cellular membranes and upset other vital cellular functions. Susceptibility to paraquat toxicity may be increased by deficiencies of vitamin E or selenium. Some conflicting reports exist concerning the benefits of antioxidant therapy for paraquat poisoning which stress the need for more research on the mechanisms of paraquat poisoning.

81-3160. Yasaka, T.; Ohya, I.; Metsumoto, J.; Shiramizu, T.; Sasaguri, Y. (Dep. Pediatr., James Whitcomb Riley Hosp. Child., Indiana Univ. Sch. Med., Indianapolis, IN 46223) **Acceleration of lipid peroxidation in human paraquat poisoning.** *Arch. Intern. Med.* 141(9): 1169-1171; 1981 (14 references).

Acute renal and liver failure developed in a 20-yr-old man who swallowed about 15-20 ml of paraquat in a suicide attempt. The patient was started on hemodialysis and given vitamin E, but died on the 27th day of treatment due to pulmonary fibrosis. Lipid peroxidation of serum was noted upon determination of malondialdehyde levels. Similar plasma patterns of malondialdehyde were found in guinea pigs given ip doses (6 mg/kg) of paraquat. These findings suggest that increased serum or plasma levels of lipid peroxide might reflect the production of highly reactive oxygen free radicals. The concentration of lipid peroxidase in plasma or serum might serve as an indicator of the efficacy of therapy directed toward scavenging free radicals.

81-3161. Malik, J. K.; Lay, J. P.; Klein, W.; Korte, F. (Ges. Strahlen- & Umweltforschung mbH Muenchen, Inst. Oekol. Chem., D-8042 Neuherberg, BRD) **Biotransformation and disposition of the coumaphos metabolite 3-chloro-4-methyl- (4-^{14}C)-7-hydroxycoumarin in rats.** *Arch. Toxicol.* 48(1): 51-59; 1981 (12 references).

Albino Wistar rats were given ^{14}C-labeled chlorferron, a metabolite of the ectoparasitide coumaphos, in a single dose of 20 m$_3$/kg body wt. In another experiment, a group of male rats was given single equimolar doses of either ^{14}C-labeled chlorferron (0.5 mg/kg) or ^{14}C-labeled coumaphos (0.86 mg/kg). Following both dose levels of chlorferron, more than 90% of the total ^{14}C administered was excreted in urine and feces during the first 24 hr. Fecal route of excretion was minor. The total urinary and fecal recoveries of ^{14}C after a period of 7 days following the administration of coumaphos were significantly lower at 79.1% chlorferron than at 93.7% chlorferron. After both doses of chlorferron radioactivity could be detected in all the tissues analyzed. Much of the excretion occurred during the first 24 hr after injection. Results indicate that chlorferron is not the end product of coumaphos metabolism in rats, and rapidly degrades to another metabolite.

81-3162. Kitos, P. A.; Anderson, D. S.; Uyeki, E. M.; Misawa, M.; Wyttenbach, C. R. (Dep. Biochem., Univ. Kansas, Lawrence, KS 66045) **Teratogenic effects of cholinergic insecticides in chick embryos-II. Effects on the NAD content of early embryos.** *Biochem. Pharmacol.* 30(16): 2225-2235; 1981 (28 references).

Chick embryos at 72 hr of incubation were exposed *in ovo* (0.2 or 1.0 mg/egg) to the organophosphate insecticide diazinon (DZN) or dicrotophos (DCP) and examined at days 5, 7 and 10 for visible defects and changes in the protein and NAD content of the whole organism, their wings and legs. Skeletal changes of the spinal column and legs were scarcely detectable on day 5 but were readily apparent by day 10. The NAD contents of the embryos and their limbs were normal up to day 5; slightly reduced by day 7, and greatly reduced by day 10, while the wet wt and protein contents were virtually normal over this time span. Nicotinamide (8 μmol/egg on day 3) increased the NAD content of the embryos by 20-30%. If administered along with DZN or DCP, it produced an even greater increase by day 10 and minimized the insecticide-induced leg deformities. A reactivator of organophosphate-inhibited acetylcholine esterase, 2-pyridinealdoxime methochloride (2-PAM), did not affect the NAD content of control embryos during these early times. If given with the insecticide, however, it prevented the expected decrease in NAD level. Some of the effects of the cholinergic insecticides and their reversing agents on the NAD content of young chick embryos are considered in terms of their possible mechanisms of action and teratogenic implications. (Author abstract by permission)

81-3163. Frank, L. (Pulm. Div. R120, Sch. Med., Univ. Miami, Miami, FL 33101) **Prolonged survival after paraquat. Role of the lung antioxidant enzyme systems.** *Biochem. Pharmacol.* 30(16): 2319-2324; 1981 (44 references).

Treatment of O_2-exposed adult rats with low doses of bacterial endotoxin results in increased lung antioxidant enzyme activity and a marked protective effect against pulmonary O_2 toxicity. Since paraquat-induced lung damage is believed to be mediated by an O_2 free-radical mechanism, animals with increased lung antioxidant enzyme levels should better tolerate paraquat exposure. We therefore pre-exposed endotoxin-treated rats to hyperoxia for 48 hr and then administered a lethal dose (40 mg/kg) of paraquat to these animals and to non-O_2-exposed rats. The O_2-pre-exposed rats with elevated lung superoxide dismutase, catalase and glutathione peroxidase enzyme levels exhibited survival times after paraquat administration (LT50 = 7.25 days) that were prolonged more than 3-fold compared to the control, non-O_2-pre-exposed rats that had received the same dose of paraquat (LT50 = 2.0 days). This animal model with increased biochemical defense against potential hyper-oxidant toxicity may be of use in studying other toxic agents that produce lung damage through an O_2 free-radical mechanism. (Author abstract by permission)

81-3164. Heitkamp, M.; Brown, O. R. (Dep. Vet. Microbiol., Univ. Missouri, Columbia, MO 65211) **Inhibition of NAD biosynthesis by paraquat in *Escherichia coli*.** *Biochim. Biophys. Acta* 676(3): 345-349; 1981 (21 references).

Niacin significantly reduced the bacteristatic effect of 1 m*M* paraquat for *Escherichia coli*. Without niacin (an intermediate in the salvage pathway for pyridine nucleotide coenzyme biosynthesis), the NAD concentration was decreased rapidly and significantly in *E. coli* during paraquat poisoning. Niacin prevented the decline in NAD in paraquat-poisoned cells; quinolinate (an intermediate in *de novo* NAD biosynthesis prior to the entry point of niacin) did not. These data suggest that paraquat poisons the *de novo* pathway of pyridine nucleotide coenzyme biosynthesis. Similar consequences have been reported to result from hyperbaric oxygen poisoning of *E. coli*; thus, there is growing evidence for a common mechanism of toxicity for hyperoxia and paraquat. (Author abstract by permission)

81-3165. Gentile, R.; Sciscioli, V.; Milillo, M. A.; Pagano, M. (Ist. Istol. Gen. & Spec., Fac. Med. Vet., Univ. Bari, Italy) **Modificazioni istologiche ed istochemiche indotte da intossicazione da warfarin sul fegato di maiale. [Histological and histochemical changes induced by warfarin in the pig liver.]** *Boll. Soc. Ital. Biol. Sper.* 57(5): 533-539; 1981 (7 references) (Italian).

Histological and histochemical changes induced in pig livers by warfarin are described. Single doses between 50 and 100 mg/kg body wt are lethal to all animals. Smaller doses ingested over a period of days cause slow poisoning. Repeated ingestion of small doses cause greater damage than the administration of 1 massive dose; the progressive toxic effect is manifested by blockage of prothrombin synthesis by the liver resulting in anemia and weakness, blood in feces, and vomit. These symptoms appear 20 hr following ingestion, and peak after 36 hr, when all prothrombin synthesis is arrested. Other symptoms of poisoning include dyspnea, intramuscular blood effusions, pulmonary hemorrhages, irregular heartbeat, and convulsions. On liver sections hemorrhages and changes in consistency of the tissue occur, with the hepatic parenchyma fragile and almost liquefied. Slight changes in the liver lobule structure on eosine-dyed sections and increased enzymatic activity are also found.

81-3166. Wallace, J. B.; Webster, J. R.; Cuffney, T. C. (Univ. Georgia, Athens, GA) **Effects of insecticide treatment on detritus dynamics in a headwater stream.** *Bull. Ecol. Soc. Am.* 62(2): 67-68; 1981.

A small Appalachian forest stream was treated with insecticide, resulting in a massive downstream drift and reduced aquatic insect density. The aquatic insect population was reduced to < 10% of an adjacent reference stream. In the treated stream the breakdown rates of leaf detritus were significantly slower than in the reference stream. The treated stream also exhibited significantly slower downstream transport of particulate organic matter. The findings suggest that consumers have a major role in energy dynamics of headwater streams and regulate detrital energy flow to downstream reaches. [Presented at the 1981 annual meeting of the Ecological Society of America with AIBS]

81-3167. Denoyelles, F., Jr.; Kettle, D. (Univ. Kansas, Lawrence, KS) **The effect of photoinhibitory chemicals on the structure and function of phytoplankton communities.** *Bull. Ecol. Soc. Am.* 62(2): 73; 1981.

Controlled additions of the herbicide atrazine were made to experimental ponds. Phytoplankton growth was depressed within a few days after the addition of 20 or 500 μg/l atrazine, but within a few wk returned to control pond levels. The return to control levels was caused by the establishment of resistant species in the phytoplankton communities. Certain zooplankton species suffered inhibited reproduction cycles due to food reductions. The potential effects of herbicides in aquatic communities and the production of secondary effects are demonstrated. [Presented at the 1981 annual meeting of the Ecological Society of America with AIBS]

81-3168. Robinson-Wilson, E. (Columbia Natl. Fish. Res. Lab., Columbia, MO) **The function of rooted aquatic macrophytes with respect to contaminant stress.** *Bull. Ecol. Soc. Am.* 62(2): 73-74; 1981.

Pentachlorophenol (PCP) was applied to 3 different lotic ecosystems. One of these ecosystems contained heavy macrophyte growth. The survival of adult bluegill and largemouth bass was higher in the macrophyte ecosystem. The total amount of free PCP in the macrophyte ecosystem was significantly lower than in the other ecosystems. It is suggested that PCP may be metabolized by the macrophytes, and that complete removal of all macrophytes with herbicides may result in reduced biomass of fish in lotic ecosystems. [Presented at the 1981 annual meeting of the Ecological Society of America with AIBS]

81-3169. Boyle, T. P. (Columbia Natl. Fish. Res. Lab., Columbia, MO) **Changes in structure and function of aquatic invertebrate communities due to insecticide stress.** *Bull. Ecol. Soc. Am.* 62(2): 74; 1981.

Four outdoor experimental ponds were treated biweekly with 10 μg/l Dimilin (diflubenzuron). Four ponds were treated monthly with similar concentrations; 4 additional ponds were left untreated. Weekly samples were taken for 14 wk. These samples indicated increases in planktonic chlorophyll *a* gross primary production, ^{14}C uptake, and algal nitrogen fixation. These increases resulted from the removal of the zooplankton community. Nitrogen and phosphorus concentrations were also greater in treated ponds. The total production of bass and bluegill sunfish was considered reduced relative to control ponds. [Presented at the 1981 annual meeting of the Ecological Society of America with AIBS]

81-3170. LeBlanc, G. A. (E G & G, Bionomics, Aquat. Toxicol. Lab., Wareham, MA 02571) **Acute toxicity of priority pollutants to water flea (*Daphnia magna*).** *Bull. Environ. Contam. Toxicol.* 24(5): 684-691; 19801 (3 references).

Toxicity tests of selected priority pollutants, including pesticides, were conducted using *Daphnia magna* < 24 hr old. Observations of test populations exposed to 83 different pollutants were made at 24 and 48 hr, and mortalities were recorded. LC50 values were calculated based on the concentrations to which the fleas were exposed at the beginning of each test. The data are summarized in tabular form. In general, the chlorinated phenols were more toxic than the chlorinated benzenes, chlorinated ethanes, and nitrated phenols. The 24-hr and 48-hr LC50s for PCP were 1.5 mg/l and 0.68 mg/l, respectively. The 24-hr and 48-hr LC50s for trichlorobenzene were 110 mg/l and 50 mg/l, respectively.

81-3171. Vangilder, L. D.; Peterle, T. J. (Dep. Zool., Ohio State Univ., Columbus, OH 43210) **South Louisiana crude oil and DDE in the diet of mallard hens - effects on reproduction and duckling survival.** *Bull. Environ. Contam. Toxicol.* 25(1): 23-28; 1980 (17 references).

The effects of south Louisiana crude oil (SLCO) and DDE on the reproductive performance of mallard hens and on the ability of offspring of these hens to survive under energetically poor conditions were studied. Hens received a diet containing either 10 ppm DDE or SLCO at a concentration of 2%, and after 2 mo were released with untreated mallard drakes. Fertility, hatchability, and eggshell thickness were recorded. Survival of 1-hr-old ducklings at a temperature of 20°C was recorded to determine survival ability under energetically poor conditions. Both DDE and SLCO delayed the onset of laying, reduced hatchability (22% reduction in DDE hens and 45% reduction in SLCO hens), and produced thinner egg shells (5% thinner in DDE hens and 16% thinner in SLCO hens). Egg production was reduced by SLCO, but not by DDE. Neither treatment affected fertility. Ducklings produced by DDE and SLCO hens survived 5.1 and 9.7 hr less, respectively, than did control ducklings. The mechanisms for these effects are unknown, but it is suggested that SLCO or DDE may slow the development of neural and endocrine processes. These data indicate that the effects of SLCO and DDE on reproduction in birds may be more severe than previously demonstrated.

81-3172. Hirayama, K.; Tamanoi, S. (Fac. Fish., Nagasaki Univ., Nagasaki 852, Japan) **[Acute toxicity of MEP and diazinon (pesticide) to larvae of Kuruma Prawn *Penaeus japonicus* and of swimming crab *Portunus trituberculatus*.]** *Bull. Jpn. Soc. Sci. Fish.* 46(2): 117-123; 1980 (12 references) (Japanese).

In acute toxicity studies, 24 hr TLm values of MEP and diazinon were determined at ~ 25°C for *Penaeus japonicus* and *Portunnus trituberculatus*. For *P. japonicus* treated with MEP, the TLm values decreased with larval development. Highest values (1.9 ppm) were at nauplius stage, and the lowest values ($5.0\text{-}9.0 \times 10^{-4}$ ppm) at post larval stage. Diazinon produced the same trend, with a 24 hr TLm of 20 ppm at nauplius and $2.0\text{-}5.0 \times 10^{-2}$ ppm post larval. A similar pattern was seen for *P. trituberculatus*, with the lowest 24 hr Tlm values found at the first stage just after hatching. Concentrations of the pesticides < 24 TLm values also retarded molting in larvae. When *P. trituberculatus* larvae were exposed to MEP at a concentration close to the 24 hr TLm, effects on oxygen consumption were hardly detected.

81-3173. Perocco, P.; Prodi, G. (Ist. Cancerologia, Univ. Bologna, I-40100 Bologna, Italy) **DNA damage by haloalkanes in human lymphocytes cultured in vitro.** *Cancer Lett.* 13(3): 213-218; 1981 (14 references).

A short-term *in vitro* system using human lymphocytes was used to study the DNA damaging activity of 7 haloalkanes, including the fumigant 1,2-dibromoethane (ethylene dibromide). The inhibition of scheduled and unscheduled DNA syntheses, detected by tritiated thymidine uptake, was measured. The results indicated that 1,2-dibromoethane was a DNA damaging agent. These data agreed substantially with other studies of experimental systems using bacterial cells or lower eukaryotes. In this short-term system, positive results were noted only after metabolic activation of the chemicals.

81-3174. Zilkah, S.; Osband, M. E.; McCaffrey, R. P. (Med. Oncol. Sec., Univ. Hosp., Boston Univ., Boston, MA 02118) **Characterization of the inhibitory effects of the phytotoxic agent propachlor (α-chloro-*N*-isopropylacetanilide), on L1210 cell proliferation.** *Cancer Lett.* 13(3): 241-248; 1981 (10 references).

When tested *in vitro* against L1210 cells, propachlor inhibited on cell proliferation ($ID50 < 3 \times 10^{-7} M$). Propachlor also significantly inhibited the uptake of leucine, thymidine, and uridine. The inhibitory effects on cell proliferation and precursor uptake were present after the first day of culture. The inhibitory effect of propachlor was largely reversible; cells grown in propachlor and then washed returned to a nearly normal rate of proliferation. The effects of propachlor were dependent on cell density, with greater activity at higher propachlor:cell ratios. The concentration of propachlor exhibiting inhibitory effects on L1210 cells is similar to the concentrations employed in therapeutic treatments using cancer chemotherapeutic drugs. The inhibition of cell proliferation by propachlor was greater than the effect of the compound on DNA, RNA, and protein synthesis. The relatively low toxicity of this chemical to animals and their ability to metabolize and detoxify the compound encourages further study of propachlor as a possible cancer chemotherapeutic agent.

81-3175. Tennekes, H. A.; Wright, A. S.; Dix, K. M.; Koeman, J. H. (German Cancer Res. Cent., Inst. Biochem., D-6900 Heidelberg, BRD) **Effects of dieldrin, diet, and bedding on enzyme function and tumor incidence in livers of male CF-1 mice.** *Cancer Res.* 41(9:1): 3615-3620; 1981 (26 references).

CF-1 mice were reared on filter-paper or sawdust bedding and fed conventional or semisynthetic diets. Exposure of CF-1 mice to dieldrin po had no effect on body wt. Mice fed conventional diet had slightly higher body wt than those maintained on semisynthetic diets, but this tendency disappeared with increasing duration of treatment. The administration of 10 mg dieldrin/kg diet resulted in pronounced liver enlargement, ranging from 37.5% in mice reared on filter paper bedding and fed conventional diets to 56.5% in mice maintained on sawdust bedding and semisynthetic diets. Liver enlargement induced by dieldrin was accompanied by the induction of drug-metabolizing enzymes such as p-nitroanisole-O-demethylase, epoxide hydratase, glutathione-S-epoxide transferase, and UDP-glucuronyltransferase activity. A significant reduction in the survival time of mice exposed to dieldrin was noted. Fifty % of the animals receiving 10 mg dieldrin/kg diet survived to wk 86; 50% of the animals not receiving dieldrin survived to wk 94. The administration of dieldrin resulted in the relatively early appearance of nodular hepatic lesions. The study demonstrated that dieldrin facilitated or exacerbated the expression of an endogenous oncogenic factor in CF-1 mice. These effects might be caused by the induction of liver enlargement and concomitant liver cell proliferation.

81-3176. McLeese, D. W.; Zitko, V.; Sergeant, D. B.; Burridge, L.; Metcalfe, C. D. (Fish. & Environ. Sci., Dep. Fish. & Oceans, Biol Stn., St. Andrews, New Brunswick E0G 2X0, Canada) **Lethality and accumulation of alkylphenols in aquatic fauna.** *Chemosphere* 10(7): 723-730; 1981 (11 references).

The lethality and accumulation of alkylphenols (including nonylphenol) was studied in shrimp and juvenile Atlantic salmon. Both static and flow-through tests were applied, using a variety of concentrations. Water samples were taken at intervals up to 48 hr. Uptake and excretion tests were also carried out on salmon, and salmon tissues were analyzed by gas chromatography. In shrimp (*Crangon septemspinosa*) lethal thresholds of alkylphenols ranged from 0.15 mg/l for *p*-nonylphenol to 2.7 mg/l for *p*-tert-pentylphenol. In salmon (*Salmo salar*), lethal thresholds ranged from 0.15 mg/l for *p*-dodecylphenol to 1.0 mg/l for *p-sec*-butylphenol, with 0.18 mg/l for p-nonylphenol. Generally, increasing octanol/water partition coefficients resulted in decreasing lethal thresholds. In salmon, bioconcentration factors ranged from 37 for *p-sec*-butylphenol to 6000 for *p*-dodecylphenol. A bioconcentration factor of 10 has been reported previously for nonylphenol. The data presented indicate that the alkylphenols are sufficiently toxic to warrant a more detailed study of their sources, environmental fate, and effects.

81-3177. Lutz-Ostertag, Y.; Bruel, M. T. (Lab. Biol. Anim., E.R.A., C.N.R.S., Univ. Clermont-II, F-63170 Aubiere, France) **Action embryotoxique et teratogene du dichlorovos (insecticide organophosphore) sur le developpement de l'embryon de Caille. [Embryotoxic and teratogenic effect of the organophosphorus insecticide dichlorvos on the development of quail embryos.]** *C. R. Acad. Sci. Ser. A* 292(18): 1051-1054; 1981 (French).

Quail eggs in aluminum, plastic, and cardboard boxes were exposed to an atmosphere containing 0.00218 mg dichlorvos/m^3 and incubated at 38.5°C. The embryos formed were sacrificed after 6-14 days of incubation and compared with unexposed controls. Highest mortality

(42.81%) occurred in aluminum boxes. In plastic and cardboard boxes mortality was 25.75 and 23.72%, respectively. In addition to toxic effects, dichlorvos was found to have a teratogenic effect on all exposed embryos manifested by multiple malformations (lordosis, scoliosis). This was suggested to be due to anticholinesterase activity of the pesticide, demonstrated previously on rats, monkeys, horses, and pigs. It was concluded that egg shells do not protect the embryos; the insecticide vapor penetrates easily through the pores. Another organophosphorus compound, parathion, was found to cause similar malformations. Dichlorvos was found to permeate aluminum; even after washing the boxes, subsequent unexposed hatches were affected. Plastic and cardboard boxes were safe after washing.

81-3178. Ghali, G. Z. (Purdue Univ., West Lafayette, IN) **The metabolic basis for the acute and chronic toxicity of formamidine pesticides.** *Diss. Abstr. Int. B* 42(1): 57; 1981.

The formamidine pesticide chlordimeform (CDM) shows moderate acute toxicity to mammals. The *N*-demethylation of chlordimeform yields metabolites of increasing acute toxicity, but of lower chemical and biological stability. Studies of the tissue levels of CDM and its metabolites in mice after pretreatments affecting MFO activity indicated that the best correlation to account for the resulting variations in the toxicity of CDM is with the level of total formamidines in the brain. It is therefore concluded that although the successive *N*-demethylations of CDM are potential activation steps, they are not obligatory for the overall toxicity of CDM. In order to examine the metabolic basis for the carcinogenic activity of the formamidine pesticides, chlordimeform and amitraz, the behavior of these formamidines and some of their common metabolites was investigated in Ames *Salmonella* mutagenicity assay. The only positive responses were shown by the bacterial tester strains TA98 and TA100 with the aniline metabolites of chlordimeform and amitraz. Metabolic activation by liver homogenates was essential for this response. When other selected mono- and disubstituted anilines were tested on strain TA100, it was found that ortho-para distribution with a methyl group in the ortho position favored mutagenic activity. Unfortunately, it is precisely this substitution pattern with favors pesticidal activity. Thus it may be difficult to develop pesticidal formamidines which are not potential mutagens and carcinogens through metabolic release of their parent anilines. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8113684)

81-3179. Badayeva, L. M. (Inst. Hyg. & Toxicol. Pestic., Polym., & Plast., USSR Minist. Public Health, Kiev, USSR) **Otsinka neiroembriotoksychnoyi diyi pestytsydiv z dopomogoyu kompleksu morfologichnykh ta funktsional'nykh doslidzhen'. [Evaluation of the neuroembryotoxic effect of pesticides using a complex of morphological and functional research.]** *Dopov. Akad. Nauk Ukr. RSR Ser. B* (6): 85-88; 1981 (7 references) (Ukrainian).

In the absence of morphological criteria for estimating the neuroembryotoxic effect of pesticides, a systemic and structural approach was employed for detecting primary reactions of nervous system damage in the mother-fetus system affected by pesticides. The methodical approach, combined with electron microscopic, neurohistological, and histochemical methods and chromatographic analysis, makes it possible to reveal sensitive and informative morphological indices of pesticide neuroembryotoxic action. The effect of polychlorocamphene (toxaphene) and dilor on nerve fiber, neurons, spinal cord synapses, and heart was studied in pregnant rats and their progeny. The anticholinesterase effect of pesticides was used to evaluate their neuroembryotoxic action.

81-3180. Beck, D. E.; Freeman, B.; Moore, C. R. (Dep. Pharm., Univ. Hosp., Birmingham, AL 35233) **Toxicities with intravenous and subcutaneous administration of a petroleum distillate.** *Drug Intell. Clin. Pharm.* 15(9): 693-694; 1981 (4 references).

A 27-yr-old man injected himself both iv and sc with 4-9 ml of an activated roach and ant killer (trade name Hot Shot). Onset of coughing occurred 2 hr later, followed 5 hr after injection by nausea and a single episode of vomiting. Shortness of breath, dyspnea, diffuse abdominal and back pain, and loose stool occurred about 12 hr after injection. Chest x-ray revealed diffuse patchy alveolar and interstitial infiltrates in both lungs and a normal heart silhouette. Arterial blood gases and electrocardiograms were normal on the second day after admission. Nafcillin (500 mg iv every 4 hr) was begun. By hospital day 5 the chest x-rays were clearing and nafcillin was stopped. The product that had been injected contained about 98.8% petroleum distillates. Local toxicities were also observed around the area of injection consisting of extensive subcutaneous necrosis with pockets of necrotic material, which were debrided.

81-3181. Douthwaite, R. J. (Cent. Overseas Pest Res., Coll. House, London W8 5SJ, England) **Occurrence of birds in *Acacia* woodlands in northern Botswana related to endosulfan sprayed for tsetse fly control.** *Environ. Pollut. Ser. A* 22(4): 273-281; 1980 (4 references).

A study was designed to determine the impact on birds of the sequential spraying of endosulfan for the con-

trol of the tsetse fly in Africa. Between July 15 and October 9, 1978, 25 km² of primarily *Acacia* woodland were sprayed 6 times with endosulfan at application rates of 6, 9.5, or 12 g/ha. Before and after the spraying, a bird census was taken by recording all birds seen and heard in a slow 5-min walk, with recordings at 20 points, 0.5 kg apart, along each transect. During the spraying season, bird species diversity increased, and no species suffered catastrophic decline. The chi-square test was applied to determine whether change in proportions of each species before and after spraying were the same in sprayed and unsprayed areas. In addition, 39 species and species groups were compared with regard to diet. Some changes in the occurrence of the different species differed in the sprayed and unsprayed areas, but the varied habits of the species showing divergent changes make it unlikely that spraying alone was responsible. Changes in the insectivorous species were similar in the sprayed and unsprayed areas. The data support the view that, on environmental grounds, several light applications of endosulfan are preferable to a single heavy spray.

81-3182. Bogden, J. D.; Kemp, F. W.; Troiano, R. A.; Jortner, B. S.; Timpone, C.; Giuliani, D. (Dep. Prev. Med. & Commun. Health, Coll. Med. & Dent. New Jersey, New Jersey Med. Sch., Newark, NJ 07103) **Effect of mercuric chloride and methylmercury chloride exposure on tissue concentrations of six essential minerals.** *Environ. Res.* 21(2): 350-359; 1980 (32 references).

There are few data on the effects of mercury exposure on tissue concentrations of essential minerals. Male Sprague-Dawley rats were exposed to mercuric chloride and methylmercury chloride administered via the drinking water. Subsequently, the kidneys, spleen, liver, and brain were analyzed for mercury, calcium, copper, magnesium, manganese, iron, and zinc by atomic absorption spectrophotometry. Significant differences from controls were found for brain copper, kidney copper, and kidney zinc in the mercuric chloride-exposed animals; and for brain iron, kidney copper, kidney iron, kidney magnesium, spleen magnesium, and liver manganese in the methylmercury chloride-exposed rats. There was a 5-fold higher mean kidney copper concentration in the mercuric chloride-exposure group: this may be related to the induction of renal metallothionein synthesis by mercury. Increased kidney copper may be a manifestation of heavy metal-induced renal toxicity. Both inorganic and methylmercury exposure produce significant changes in tissue concentrations of some essential minerals. (Author abstract by permission)

81-3183. Shiota, K.; Shou, M. J.; Nishimura, H. (Dep. Anat., Fac. Med., Kyoto Univ., Kyoto, Japan) **Embryotoxic effects of di-2-ethylhexyl phthalate (DEHP) and di-*n*-butyl phthalate (DBP) in mice.** *Environ. Res.* 22(1): 245-253; 1980 (32 references).

Two major compounds of PVC plasticizers, di-2-ethylhexyl phthalate (DEHP; dioctyl phthalate) and di-*n*-butyl phthalate (DBP), were mixed with food at levels of 0.05, 0.1, 0.2, 0.4, and 1.0 wt% and given to pregnant mice of ICR-JCL strain throughout gestation. Treatment with 0.2, 0.4, and 1.0% DEHP and 1.0% DBP resulted in decreased maternal wt gain and increased resorption rate. All of the implanted ova died *in utero* at 0.4 and 1.0% level of DEHP. The malformation rate in term fetuses increased at 0.2% level of DEHP and 1.0% level of DBP, the difference from the control group being at the borderline level of significance. The major malformations observed in the treated groups were neural tube defects (exencephaly and spina bifida), suggesting that the phthalic acid esters could interfere with the closure of neuropores in developing embryos. Treatment with the compounds caused intrauterine growth retardation and delayed ossification with an apparently dose-related response pattern. These results indicated that DEHP and DBP at a high dose level could be embryotoxic and possibly teratogenic mice. The maximum no effect level of the PAEs on mouse fetuses was 70 mg/kg/day, which is far higher than the estimated human current intake from the environment. (Author abstract by permission)

81-3184. Gupta, P. K.; Sastry, K. V. (Dep. Zool., Sch. Environ. Contam. Toxicol., D.A.V. P.G. Coll., Muzaffarnagar, India) **Alterations in the activities of three dehydrogenases in the digestive system of two teleost fishes exposed to mercuric chloride.** *Environ. Res.* 24(1): 15-23; 1981 (37 references).

The effect of the 50% lethal concentration (LC50) (1.8 and 1.4 mg/l) and of a sublethal concentration (0.3 mg/l) of mercuric chloride on the activities of succinic, lactic, and pyruvic dehydrogenases in the digestive system of 2 teleost fishes, *Ophiocephalus punctatus* and *Heteropneustes fossilis*, respectively, has been studied at intervals of 96 hr and 7, 15, and 30 days. The results show that dehydrogenases are not affected much by short-term exposure. However, the activities of all 3 enzymes are inhibited by chronic exposure to mercury and maximum inhibition is observed after 15 days of exposure. Among the different parts of the digestive system, the liver is the most affected organ, and of the 2 fishes, *Heteropneustes* is more sensitive to mercury treatment. (Author abstract by permission)

81-3185. Barabas, K.; Vigh, L.; Horvath, I.; Szabo, L.; Matkovics, B.* (Biol. Isot. Lab., AJ Univ., Szeged, Hungary) **Effect of paraquat *in vivo* on fatty acids of**

mouse and guinea pig tissues. *Gen. Pharmacol.* 12(4): 225-227; 1981 (10 references).

The fatty acid composition of homogenates of liver, kidney, and lung of rats and guinea pigs poisoned *in vivo* with paraquat was examined by gas liquid chromatography. The organ homogenates of animals given oral LD50 or LD100 doses of paraquat showed dose-dependent effects on fatty acid compositions. An LD100 dose to mice caused increases in lung homogenate levels of palmitic, stearic, palmitoleic and arachidonic acids. Liver homogenates of exposed mice showed decreased palmitic, oleic and arachidonic acid levels and increased levels of palmitoleic and α-linoleic acids. In kidney homogenates from paraquat-treated mice, the palmitic acid responded similarly as in the lung to the 2 paraquat doses. In the guinea pig organ homogenates, the quantitative changes in the fatty acids also differed, depending on the paraquat concentration given to the animals.

81-3186. Barabas, K.; Varga, S.I.; Matkovics, B. (Inst. Hyg. & Epidemiol., Univ. Med. Sch. Szeged, Hungary) **Serum protein and glycoprotein changes in chronic paraquat intoxication.** *Gen. Pharmacol.* 12(4): 229-231; 1981 (5 references).

A model chronic toxicity experiment was carried out on New Zealand white rabbits to assess the effects of long-term paraquat exposure on mammals. Slow changes in the blood plasma protein fractions occurred when paraquat was given orally in a 25% solution 4 times/wk for 12 wk. Blood α-fractions of glycoproteins and β- and γ-globulin levels increased. The relationship of paraquat toxicity to mammalian autoimmune reactions is discussed.

81-3187. Kadir, H. A.; Knowles, C. O. (Dep. Entomol., Univ. Missouri, Columbia, MO 65211) **Inhibition of rat brain monoamine oxidase by insecticides, acaricides and related compounds.** *Gen. Pharmacol.* 12(4): 239-247; 1981 (20 references).

The *in vitro* inhibition of deamination of biogenic amine substrates by rat brain monoamine oxidase (MAO) was tested with 61 insecticides, acaricides, and related compounds. Twenty-eight of the compounds (6 organophosphates, 4 carbamates, 8 formamidines, and 2 sulfonates) gave over 50% inhibition of the deamination of at least one substrate at assay levels of 0.001 *M*. Potasan was the most potent organophosphate MAO inhibitor and carbaryl the most potent carbamate MAO inhibitor. Chlordimeform competitive inhibition values were slightly less than those of its *N*-demethyl derivative. The most potent inhibitor of serotonin and dopamine deamination was ovex (chlorfenson) with pI50 values of 6.15 and 5.90, respectively.

81-3188. Prashad, D. N.; Chambers, D.; Beadle, D. J. (Sch. Biol. Sci., Thames Polytech., London SE18, England) **Changes in renal function associated with paraquat dichloride toxicity in the domestic fowl.** *Gen. Pharmacol.* 12(4): 291-293; 1981 (14 references).

The renal responses to challenge by paraquat dichloride were studied in hens exposed to 25 μg/g of the pesticide through cannulated left brachial veins during mannitol diuresis. After dosing with paraquat dichloride, the rate of urine flow declined progressively. Glomerular filtration rate was also decreased, while the renal clearance of paraquat dichloride exceeded the filtered load soon after administration of the herbicide. The increased clearance of paraquat paralleled that of para-aminohippuric acid. It was suggested that the iv administration of paraquat dichloride to hens may give rise to increases in renal peritubular blood flow.

81-3189. Gopalan, H. N. B.; Njagi, G. D. E. (Dep. Bot., Univ. Nairobi, Nairobi, Kenya) **Mutagenicity testing of pesticides.** *Genetics* 97(S1): S44; 1981.

The pesticides Sumithion (fenitrothion), Kelthane (dicofol), Ramrod (propachlor), Roundup (glyphosate), 2,4-D, Benlate (benomyl), atrazine, Hyvar X (bromacil) and Lannate (methomyl) were tested for the induction of sex-linked recessive lethals on *Drosophila melanogaster*. None of the chemicals induced recessive lethals. The differences in the scores of the 4 phenotypic classes of flies in F2 were significant. All the chemicals induced anaphase bridge formation, premature chromosome condensation and a variety of mitostatic effects in *Vicia faba*. In the Ames test Lasso (alachlor), atrazine, Hyvar, Lannate and Kelthane induced point mutations by restoring histidine auxotrophs of *Salmonella typhimurium* to prototrophy, without metabolic activation.

81-3190. Yusupov, A. M. (Abu Ali ibn-Siny Tadnhik Med. Inst., Dushanbe, USSR) **Deistvie granozana na organizm zhibotnykh v usloviyakh vysokogor'ya i barokamernoi gipoksii. [Effect of Granosan on animals under conditions of high altitude and barochamber hypoxia.]** *Gig. Sanit.* 46(6): 17-20; 1981 (8 references) (Russian).

Acute experiments with a single administration of Granosan (ethylmercuric chloride) were conducted in mice (10-50 mg/kg) and rats (20-80 mg/kg) under high altitude conditions. Multiple administrations in rabbits were performed under conditions of high altitude and barochamber hypoxia. Toxicity was higher under these conditions than in a valley. The cumulative action of Granosan under high altitude conditions, evaluated according to lethal effect, was more marked. Administration of Granosan at 0.02 LD50 over a 28-day period during barochamber hypoxia and for 62 days in a valley led to death of all rabbits. Granosan adversely affected hypoxia-adapted animals to a noticeably greater extent than unadapted ones. The tox-

icological, biochemical and hematological indices obtained were in good agreement with morphological findings. It is concluded that mercury-containing pesticides should not be used at all at high and medium altitudes.

81-3191. Shepel'skaya, N. R. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Otsenka gonadotoksicheskogo effekta Tsiodrina v eksperimente. [Evaluation of the gonadotoxic effect of Ciodrin in an experiment.]** *Gig. Sanit.* 46(6): 81-82; 1981 (2 references) (Russian).

The insectoacaricide Ciodrin (crotoxyphos) at doses of 0.01 and 0.005 mg/kg had a marked toxic effect on gonads of male and female rats, as indicated by morphofunctional indices, reproductive function and postnatal development of progeny. The degree of expression of this effect was dose-dependent. The maximum permissible quantity of the preparation in meat is 0.005 mg/kg. It is concluded that existing standards conform to hygienic requirements.

81-3192. Hiraoka, Y. (Sch. Hyg., Fac. Med., Hiroshima Univ., Hiroshima, Japan) **[Studies on the vertebral abnormalities of Medaka as the biological index of water pollution. VII. Vertebral abnormalities in the next generation of Medaka treated by MEP (fenitrothion).]** *Hiroshima Daigaku Igaku Zasshi (Med. J. Hiroshima Univ.)* 29(2): 303-308; 1981 (19 references) (Japanese).

Experiments were done to study vertebral abnormalities in the offspring of *Orizias latipes* exposed to fenitrothion. Newly hatched fry were exposed to an aqueous solution (0.5 ppm) of fenitrothin for 1 wk, and they were reared in dechlorinated tap water to adulthood ($E\text{-}F_1$). A high incidence of external and vertebral abnormalities was observed in the adult fish. Some males and females with external abnormalities and some normal males and females were selected from the surviving individuals ($E\text{-}F_1$) to spawn. The fertilized eggs were reared in dechlorinated tap water to adulthood ($D\text{-}F_2$ and $N\text{-}F_2$, respectively). The rate of egg hatching was found to be remarkably low in either group. External abnormalities were not observed in either $N\text{-}F_2$ or $D\text{-}F_2$. Whether $E\text{-}F_1$ had external abnormalities or not did not affect the occurrence of vertebral abnormalities in the next generation. The incidence of fish with damaged vertebra was lower in $N\text{-}F_2$ and $D\text{-}F_2$ than $E\text{-}F_1$, but higher than in the control group. No difference in the incidence of fish with abnormality of the centrum was observed between $N\text{-}F_2$, $D\text{-}F_2$, and the control group. From these results, it may be inferred that the incidence of fish with abnormality of the centrum is highly reliable as a biological index of water pollution.

81-3193. Vardia, H. K.; Durve, V. S. (Dep. Limnol. & Fish., Univ. Udaipur, Udaipur 313001, India) **The toxicity of 2,4-D to *Cyprinus carpio* var. *communis* in relation to seasonal variation in the temperature.** *Hydrobiologia* 77(2): 155-159; 1981 (21 references).

Studies were conducted to determine the effects of temperature on the toxicity of 2,4-D to carp. Tests were conducted at 6 different temperatures ranging from 17.0 to 39.0°C to determine possible seasonal trends. Test fish were exposed to a range of concentrations of the herbicide, from 3.2 to 45 ppm, and the percent mortality at various intervals (from 24 to 96 hr) was determined. The tests indicated that elevated temperatures increased toxicity. Toxicity increased 7-75-fold as temperature increased from 17 to 39°C. The seasonal variation in the toxicity of 2,4-D to fish should be an important consideration in the management of aquatic weed eradication programs.

81-3194. Shukla, G. S.; Mishra, P. K. (Pollut. Relevant Lab., Dep. Zool., Univ. Gorakhpur, Gorakhpur 273001, India) **Bioassay studies on effects of carbamate insecticides on dragonfly nymphs.** *Indian J. Environ. Health* 22(4): 328-335; 1980 (19 references).

The toxicity of the insecticides Furadan (carbofuran), Zectran (mexacarbate), and carbaryl to dragonfly (*Brachythermis contaminata*) nymphs was studied. Static bioassays were carried out using a variety of concentrations; % mortality was determined at 24, 48, 72, and 96 hr. Relative toxicities as well as LC16, LC50, and LC84 values were determined. After 48 hr of treatment, LC50 values were 0.1928×10^{-3} ppm, 0.1526×10^{-1} ppm, and 0.1065×10^{-4} ppm for Furadan, Zectran, and carbaryl, respectively. Carbaryl was found to be the most toxic of the pesticides tested, and Furadan the least toxic. It was determined that safe concentrations of Furadan, Zectran, and carbaryl to nymphs of *B. contaminata* were 0.02673×10^{-3} ppm, 0.04128×10^{-3} ppm, and 0.01729×10^{-4} ppm, respectively.

81-3195. Roach, S. H.; Hopkins, A. R. (Cotton Insects Res., Agric. Res., SEA, USDA, Florence, SC 29503) **Reduction in arthropod predator populations in cotton fields treated with insecticides for *Heliothis* spp. control.** *J. Econ. Entomol.* 74(4): 454-457; 1981 (10 references).

The impact of fenvalerate and American Cyanamid AC-222.705 [(±)-cyano(3-phenoxyphenyl) methyl(+)-4-(difluromethoxy) -α- (1-methylenyl)benzeneacetate)], both of which are pyrethroids, toxaphene + methyl parathion, and monocrotophos on arthropod predator populations in cotton was observed in 1978 and 1979. Two or more spray treatments of the pyrethroids at concentrations of 0.11 and 0.056 kg of AI/ha essentially eliminated most predator species. The toxaphene + methyl parathion and monocrotophos at recommended rates had the same effect on arthropod predator populations. (Author abstract by permission)

81-3196. Parrella, M. P.; McCaffrey, J. P.; Horsburgh, R. L. (Dep. Entomol., Univ. California, Riverside, CA 92521) **Population trends of selected phytophagous arthropods and predators under different pesticide programs in virginia apple orchards.** *J. Econ. Entomol.* 74(4): 492-498; 1981 (29 references).

Population trends of selected pests in Virginia apple orchards [*Pamonychus ulmi* (Koch), *Aculus schechtendali* (Nalepa), *Aphis citricola* Van der Goot, *Dysaphis plantaginea* (Passerini), *Platynota* spp.] and predators [*Leptothrips mali* (Fitch), *Haplothrips subtilissimus* Haliday, *Orius insidosus* Say, *Stethorus punctum* (LeConte), *Deraeocoris nebulosus* (Uhler), *Chrysopa* spp.] were monitored during 1977 and 1978 under 3 reduced-pesticide programs. The pesticide program with phosalone and Dikar [a blend of Dithane M-45 (mancozeb; coordination product of zinc ion and manganese ethylene bisdithio=carbamate) and technical Karathane (dinocap; 2,4-dinitro-6-octylphenyl crotonate, 2,6-dinitro-4-octylphenyl crotonate, and nitro-octyl-phenols)] as its major components allowed the largest number of predators to remain in the orchard and controlled most pests. *Platynota* spp. caused economic damage during August and September, regardless of the pesticides used or the number of predators in the orchards. *L. mali* and *H. subtilissimus* were the most abundant predators and probably responded numerically to densities of *A. schlechtendali*. The presence of this mite species may aid the development of large numbers of thrips within an apple orchard. *O. insidiosus* and *D. nebulosus* usually increased too late in the season to reduce aphid populations, but aphids may be important in attracting these general predators into the orchard. *S. punctum's* response to densities of *P. ulmi* was inconsistent, but together with other predators it may have had an important role in reducing *P. ulmi* populations. *Chrysopa* spp. remained at consistently low levels throughout the study under all pesticide programs. (Author abstract by permission)

81-3197. El-Sebae, A. H.; Soliman, S. A.; Ahmed, N. S.; Curley, A. (Environ. Toxicol. Lab., Univ. Alexandria Res. Cent., Alexandria, Egypt) **Biochemical interaction of six OP delayed neurotoxicants with several neurotargets.** *J. Environ. Sci. Health B* B16(4): 465-474; 1981 (19 references).

Irreversible ataxia was observed in chickens, sheep and mice treated with the organophosphorus insecticides leptophos, EPN, cyanofenphos, trichloronate, Salithion, TOCP was included as a reference. In mouse heart preparations, cyanofenphos blocked the catecholamine β-receptor binding activity with ^{3}H-norepinephrine at nearly the same level as that of the inhibitor propranolol in mouse heart preparations. The β-receptor was more sensitive to leptophos, salithion, and TOCP than to propranolol in lamb heart preparations. The 5 organophosphorus insecticides and their oxons were also tested for their ability to inhibit monoamine oxidase, acetyl cholinesterase, and neurotoxic esterase *in vitro* in brain preparations of mouse, chicken or lamb. Results from these studies suggested that the acute toxicity of the compounds was associated with their inhibition of acetyl cholinesterase, while their ability to cause paralytic ataxia was related to their inhibition of neurotoxic esterase.

81-3198. El-Sebae, A. H.; Enan, E. E.; Soliman, S. A.; El-Fiki, S.; Khamees, E. (Res. Cent., Univ. Alexandria, Alexandria, Egypt) **Biochemical effects of some organophosphorus insecticides on new targets in white rats.** *J. Environ. Sci. Health B* B16(4): 475-491; 1981 (31 references).

The acetyl cholinesterase (AChE) inhibitory activities of RH218, profenofos and prothiophos were compared with that of fenitrothion using rat hepatic and brain AChE as substrate. Fenitrothion gave greater inhibition of AChE activity than the 3 S-*n*-propyl derivatives. Hepatic protein enhanced the inhibition of brain ChE by RH218, profenofos and prothiophos. The 4 organophosphorus esters also caused reductions in blood urea and hypoglycemia in rats.

81-3199. Matthiessen, P. (Cent. Overseas Pest Res., Overseas Dev. Adm., London W8 5SJ, England) **Haematological changes in fish following aerial spraying with endosulfan insecticide for tsetse fly control in Botswana.** *J. Fish Biol.* 18(4): 461-469; 1981 (16 references).

When endosulfan is applied aerially in low doses (6-12 g AI/ha) in the Okavango Delta, Botswana, for the control of the tsetse fly, fish mortality and toxicity is observed. Erythrocyte count, leukocyte count, hemoglobin level, and plasma protein levels were studied in several species of cichlids, catfish, and pike to evaluate fish recovery rates from exposure to endosulfan through insect spray programs. The pesticide was applied 6 times sequentially from July to October, 1978. Blood cell counts were significantly increased (up to a factor of 4) in all of the endosulfan exposed fish while plasma protein levels were decreased in some of the species during spraying and increased in others. No effects were observed on total hemoglobin but the mean wt of hemoglobin/erythrocyte was significantly reduced from 59 to 39 pg in *Tilapia* spp. Most of the values began to return to normal before spraying ceased and attained prespray levels by 6 mo after endosulfan treatment.

81-3200. Clark, D. R.; Stafford, C. J. (Patuxent Wildl. Res. Cent., US Fish & Wildl. Serv., Laurel, MD) **Effects of DDE and PCB (Aroclor 1260) on experimentally poisoned female little brown bats (*myotis lucifugus*): lethal brain concentrations.** *J. Toxicol. Environ. Health* 7(6): 925-934; 1981 (14 references).

Adult female bats *(Myotis lucifugus)* were captured from a church attic and fed mealworms containing the organochlorine pollutants DDE and PCB (Aroclor 1260). Groups of bats were dosed with 150 or 480 ppm DDE and 15 or 1000 ppm PCB until prolonged tremor produced death. Surviving bats were starved to elevate brain levels of organochlorines, and the lethal brain levels of DDE and PCB were determined. During starvation, DDE-treated bats lost wt faster than controls. The brain level of DDE which caused death ranged from 540-670 ppm, while lethal brain levels of PCB occurred at 1300 and 1500 ppm. The lethal organochlorine concentrations for little brown bats were slightly higher than those observed for Mexican free-tailed bats, common grackles, and brown-headed cowbirds.

81-3201. Buikema, A. L., Jr.; Benfield, E. F.; Niederlehner, B. R. (Virginia Polytech. Inst., Blacksburg, VA) **Effects of pollution on freshwater invertebrates.** *J. Water Pollut. Control Fed.* 53(6): 1007-1015; 1981 (105 references).

Studies of pollutant effects on freshwater invertebrates are reviewed, and a comprehensive bibliography of the literature is provided. Separate sections discuss pertinent review articles, methods, microcosms, and communities. Specific studies are cited that investigated toxicity to cladocera, other zooplankters, amphipods, decapods, insects, molluscs, protozoa, and other organisms. Of these investigations, many involve the effects of pesticides on nontarget freshwater aquatic invertebrates. Some of the pesticides that are specifically mentioned are Roundup (glyphosate), DDT, pentachloronitrobenzene, (quintozene), simazine, trifluralin, toxaphene, fenvalerate, cyanatryn, lindane, mirex, and dieldrin. Examples of toxic effects caused by exposure to pesticides include inhibition of filtering activity of the mollusc *Anodonta cygnea* by sublethal concentrations of insecticides, and the development of uncoordinated locomotor movement in the cladoceran *Daphnia pulex* when exposed to the triazine herbicide cyanatryn at 20 ppm for 15 min.

81-3202. Spehar, R. L.; Lemke, A. E.; Pickering, Q. H.; Roush, T. H.; Russo, R. C.; Yount, J. D. (US EPA, Duluth, MN) **Effects of pollution on freshwater fish.** *J. Water Pollut. Control Fed.* 53(6): 1028-1076; 1981 (376 references).

A comprehensive review of the literature on the effects of water pollution on fish is presented. Data on the acute and chronic toxicity of a wide range of inorganic and organic pollutants to freshwater fish are summarized in a table that lists the pollutant, affected species, LC50, exposure, temperature, test conditions, and reference. Studies measuring insecticide and herbicide residues in fish or establishing toxicity of insecticides and herbicides are discussed in detail. Other topics included are effects of piscicides and anesthetics, industrial and municipal effluents, inorganics, and organics.

81-3203. Lanza, G. R.; Waller, W. T. (Univ. Texas, Dallas, TX) **Substrate associated microfauna.** *J. Water Pollut. Control Fed.* 53(6): 1076-1083; 1981 (53 references).

Recent studies of substrate associated microfauna are reviewed. A study on the toxicity of pesticides is cited. Oxygen uptake was evaluated in freshwater planaria exposed to *p,p'*-DDT, *p,p'*-DDE, and *p,p'*-DDD (TDE). A 60-min exposure to beef liver perfused with 10 ml/l DDT or its metabolites in corn oil was not toxic to the planaria. The presence of a microsomal enzyme system capable of degrading DDT into DDD and DDE was suggested.

81-3204. Solomon, K. E.; Robel, R. J. (Div. Biol., Kansas State Univ., Manhattan, KS 66506) **Effects of carbaryl and carbofuran on bobwhite energetics.** *J. Wildl. Manage.* 44(3): 682-686; 1980 (12 references).

Forty-two bobwhites (quail; *Coturnix coturnix*) were assigned randomly to 4 treatment groups to be dosed with 1.0 ml corn oil or 10, 50, or 90 mg/kg carbaryl. Fifty-six other bobwhites were assigned randomly to 5 treatment groups to be dosed with 0.5 ml water, 0.5 ml corn oil, or with 0.25, 1.13, or 2.0 mg/kg carbofuran. No significant changes in body wt or energy variables were noted in quail treated with sublethal doses of either carbaryl or carbofuran. Neither carbaryl nor carbofuran treatments inhibited brain cholinesterase (ChE) activity in birds sacrificed 48 hr after initial treatment; ChE activites during the carbaryl and carbofuran studies were 32.25-52.00 and 35.75-46.50 Rappaport (R) units, respectively. Brain ChE activity of quail that died of carbaryl poisoning during an LD50 determination ranged from 0.00 to 25.00 R units.

81-3205. Keller, F.; Koeppel, C. (Klin. Steglitz FU, Med. Klin., D-1000 Berlin 45, BRD) **Hemoperfusion for organic mercury detoxication?** *Klin. Wochenschr.* 59(15): 865-866; 1981 (7 references).

A case is reported of a 49-yr-old woman who attempted suicide by ingesting 300 ml of red wine and 125 g Ceresan (fungicide, AI 3.5% methoxyethylmercury chloride). Treatment included gastric rinsing and forced diureses. A 4 hr veno-venous activated charcoal hemoperfusion was performed at 10 hr, and repeated at 15 hr after ingestion. She was treated with D-penicillamin (3 × 300 mg po daily) alternating fortnightly with dimercaprol (3 × 100 mg po daily). Local cauterization of the mouth and throat were noted. No signs of liver, kidney, or central nervous system intoxication occurred during the following 3 mo. The total amount of mercury ingested was 4375 mg. The

first gastric rinsing contained about 35% of the total ingested amount. Peak blood level 10 hr after ingestion was 2400 ng/ml; this decreased after 1 hemoperfusion to 1000 ng/ml, and increased subsequently to 1380 ng/ml. The total amount of mercury calculated to have been absorbed was 706-977 mg. It was concluded that hemoperfusion will be of limited effectiveness in organic mercury detoxication. Plasma exchange is suggested to be more effective because 93% of the blood mercury is protein bound.

81-3206. Browne, R. A. (North Carolina State Univ., Raleigh, NC 27650) Acute response versus reproductive performance in five strains of brine shrimp exposed to copper sulphate. *Mar. Environ. Res.* 3(3): 185-195; 1980 (16 references).

Studies were conducted to determine the effects of copper sulfate ($CuSO_4$) on 5 strains of brine shrimp. Chronic exposure tests were conducted by placing 20 adult *Artemia* each in brine solutions containing 10^{-1}, 1, 10^1, 10^2, 10^3, 10^4, or 10^5 ppm $CuSO_4$. Shrimp were left in the solutions until death or up to 20 days, and mean survival times (MST) were determined. The effects on reproductive performance was determined by exposing females to 0.067×10^{-9} $CuSO_4$. Before each feeding, viviparous offspring were removed and transferred to rearing jars until maturity. Oviparous offspring were filtered and dried, then repeatedly rehydrated and dried for 5 immersions. $CuSO_4$ concentrations needed to achieve MST values varied from 25,000 to $250{,}000 \times 10^{-9}$ ppm for a 10 hr survival time. A 500-hr MST required $1.2\text{-}41.2 \times 10^{-9}$ ppm. The effects on reproduction varied by strain. It appeared that treated females produced fewer offspring/brood and fewer broods/female. Tests of reproductive performance were 24,000 to 156,000 times more sensitive than standard 24-hr MST tests.

81-3207. Sharp, J. R.; Neff, J. M. (Dep. Biol., Texas A&M Univ., College Station, TX 77843) Effects of the duration of exposure to mercuric chloride on the embryogenesis of the estuarine teleost, *Fundulus heteroclitus*. *Mar. Environ. Res.* 3(3): 195-213; 1980 (34 references).

Short-term toxicity (96-hr survival) and longer-term sublethal effects of mercury as mercuric chloride on the 4-8 cell stage embryos of the estuarine fish *Fundulus heteroclitus* were determined. The embryos were exposed to 9 mercury concentrations ranging from 0 to 100 μg/l (ppb) for 1, 2, 5, and 32 days. All groups except the 32-day group were placed in Hg-free water after the exposure period. Mercury concentrations of > 40 ppb reduced survival, and levels > 10 ppb Hg^{2+} significantly reduced hatching success. Among the eleutheroembryos emerging during continuous exposure to mercury, lateral curvature of the spine occurred in 36 and 69%, respectively, of the 40- and 60-ppb groups. However, significant reductions in the disorder were seen among eleutheroembryos exposed to mercury for 1, 2, or 5 days. The results indicate that mortality is particularly high during the first 4 days of development; possible explanations for this observation are discussed.

81-3208. Saito, M.; Chiba, M. (Natl. Def. Med. Coll., Tokorozawa-shi, Saitama-ken, Japan) [Two cases of pesticide intoxication.] *Nippon Hoigaku Zasshi (Jpn. J. Legal Med.)* 34(4): 431; 1981 (Japanese).

The case of an old man found dead in the burned ruins of his house is presented. The cause of death was not apparent. He showed signs characteristic of carbon monoxide intoxication. A small amount of milky white viscous liquid was found mixed with soot in the cervical air way and in the area from the esophagus to the stomach. The unpleasant odor of the liquid noted during autopsy suggested an organophosphorus preparation. The amount of the liquid was about 20 ml. Administration of 0.5 ml of the liquid to a mouse resulted in intoxication, miosis, and death after 1 hr. Ethanol was not detected in the body. The concentration of carbon monoxide was 20%. The milky liquid was centrifuged at 3000 rpm to give a pale yellow transparent liquid, which was identified as dichlorvos. A case of a 57-yr-old woman who committed suicide by swallowing about 100 ml of the fungicide blasticidin-S-benzylamino-benzene sulfonate (2%) is presented. No specific pathological findings were made, except for fatty degeneration in the hepatic tissue. She was found < 1 hr after she had ingested the fungicide, and she died 4 days later.

81-3209. Kiuchi, M.; Sato, Y.; Kawachi, H.; Kimura, Y. (Fac. Med., Chiba Univ. Chiba, Japan) [A case of murder by poisoning with paraquat.] *Nippon Hoigaku Zasshi (Jpn. J. Legal Med.)* 34(4): 432; 1981 (Japanese).

A 41-yr-old man was forcibly administered 100 ml of a 24% preparation of the herbicide paraquat dichloride. The man was hospitalized and subjected to gastric wash and blood dialysis by activated charcoal. The patient died about 17.5 hr after ingestion. External appearance at autopsy included extensive linear exfoliation of epidermis and spot-like subcutaneous bleeding all over the body, as well as shallow openings on the arms and legs and a small stab in the abdomen, neither of which proved fatal. Internal findings were: lung—many ecchymoses on the surface, highly stagnated and hydropic; stomach—highly hyperemic in mucous membrane with bleeding in the lesser curvature side and hydrops in the greater curvature side; brain—highly stagnated and hydropic; heart—ecchymoses on the surface with dark red blood containing a lard-like blood-clot; and other organs—highly stagnated. Paraquat was extracted from blood, lung, liver, and kidney by column chromatography and was analyzed by colorimetry. The results revealed concentrations of paraquat in blood, lung, liver, and kidney to be 61.6, 78.7, 280.7, and 156.4 ppm, respectively. The cause of death was determined to be paraquat given orally by force.

81-3210. Kurisaki, E.; Nagamori, H. (Fukushima Pref. Med. Coll., Fukushima, Japan) **[Studies on intoxication due to herbicides(II). Effects of paraquat and diquat on cultured human fetal cells.]** *Nippon Hoigaku Zasshi (Jpn. J. Legal Med.)* 34(4): 433; 1981 (2 references) (Japanese).

Cultured human fetal cells were exposed to paraquat or diquat at 50, 100, 200, and 400 ppm. After exposure for 3 hr the cells were stained by nigrosine or by Sudan black B. The degree of staining of nigrosine and Sudan black B on the cells exposed to both paraquat and diquat was different from that of unexposed cells at every concentration. The mortality rate of the cells was lower in those exposed to paraquat than to diquat at 50 and 100 ppm, although no significant difference was observed over 200 ppm. After Sudan staining, remarkable fatty degeneration was observed in both exposed groups with the increase in concentration; the effect of diquat was stronger than that of paraquat. Vacuole formation was remarkable in cells exposed to paraquat at higher concentrations. No difference due to the origin of the cells (epithelial and lung) was observed for degeneration. The direct toxicity to cultured cells was stronger in diquat than in paraquat.

81-3211. Kinoyama, S.; Uchida, T.; Nagahara, A.; Harada, H.; Yokoi, S. (Dep. Intern. Med., Kagawa Pref. Cent. Hosp., Takamatsu, Kagawa, Japan) **[Autopsy record of intoxication due to swallowing paraquat dichloride.]** *Nippon Naika Gakkai Zasshi (J. Jpn. Soc. Intern. Med.)* 70(7): 70; 1981 (Japanese).

A 23-yr-old woman swallowed a mouthful of 24% paraquat dichloride herbicidal preparation. After immediate gastric wash, she was hospitalized and subjected to blood perfusion and blood dialysis 5 times during 5 days by activated charcoal column, with the simultaneous administration of steroid and fluid supplementation. Fibrosis of the lungs (paraquat lung) developed. The patient died on day 35 of hospitalization. On autopsy, the major pathological change was pulmonary fibrosis of scale-like appearance with conspicuous fibrosis of stroma. The boundary to the alveolar cavity was not clear.

81-3212. Takahashi, H.; Miyaoka, T.; Tsuda, S.; Shirasu, Y. (Inst. Environ. Toxicol., Kodaira, Tokyo, Japan) **[Reinforced mammalian acute toxicity of Bassa (*o*-*s*-butylphenyl *N*-methylcarbamate by pretreatment of mammals with fenitrothion.]** *Nippon Yakurigaku Zasshi (Folia Pharmacol. Jpn.)* 78(2): 67; 1981 (Japanese).

The synergistic effect of pretreatment of male mice po with fenitrothion on the acute toxicity of Bassa (o-s-butylphenyl *N*-methylcarbamate; BPMC) administered po was examined. The acute oral toxicity of Bassa, propoxur, *m*-tolyl *N*-methylcarbamate (dicresyl) and 3,4-xylyl *N*-methylcarbamate was reinforced 2-6-fold by 1 wk of feeding mice a diet containing 1000 ppm fenitrothion. The acute toxicity of a *N*-methylcarbamate was augmented, peaking 4 hr after po administration of 100 mg/kg fenitrothion; the synergistic effect disappeared 48-72 hr after fenitrothion administration. Prolongation sleeping time due to hexobarbital was observed with fenitrothion administration. Its peak was 4 hr after administration; the effect disappeared after 48-72 hr. The acute oral toxicity of Bassa was reduced by pretreatment of phenobarbital (80 mg/kg ip, once daily for 2 days). Phenobarbital treatment also eliminated the augmenting effect of fenitrothion (4 hr after 100 mg/kg, po). Bassa concentration in blood of mice (10 min after po administration of 20 mg/kg) was significantly higher in the mouse pretreated with fenitrothion, and significantly lower in the mouse pretreated with phenobarbital. The synergistic effect of fenitrothion was negated by phenobarbital. Augmentation of acute oral toxicity of *N*-methylcarbamates by pretreatment with fenitrothion may be caused by inhibition of the drug-metabolizing system in the liver due to the inhibition of *p*-nitroanisol metabolism by the liver microsome in the presence of an NADPH-supplying system.

81-3213. Miyaoka, T.; Takahashi, H.; Tsuda, S.; Shirasu, Y. (Inst. Environ. Toxicol., Kodaira, Tokyo, Japan) **[Reinforced mammalian acute toxicity of bassa(o-s-butylphenyl *N*-methylcarbamate by pretreatment of mammals with fenitrothion – examination of dogs.]** *Nippon Yakurigaku Zasshi (Folia Pharmacol. Jpn.)* 78(2): 67; 1981 (2 references) (Japanese).

Synergistic action of fenitrothion and Bassa (o-s-butylphenyl *N*-methylcarbamate; BPMC) in producing acute oral toxicity was examined in beagles. The MLD of fenitrothion was found to be 1400 mg/kg; at 700 mg/kg, relatively strong symptoms such as spasm, salivation, and loss of appetite were observed; at 100 mg/kg, only slight salivation was observed. The MLD of Bassa was 200 mg/kg; a clear non-linear relationship was observed between Bassa dose and the concentration in blood. Simultaneous administration of 100 mg/kg fenitrothion and 50 mg/kg Bassa, or administration of 100 mg/kg fenitrothion followed by administration of 50 mg/kg of Bassa after 6 hr, caused no beagle mortality. Pretreatment with fenitrothion for 7 days at 5 mg/kg/day, followed by administration of Bassa at 100 mg/kg, resulted in the death of 1 of 3 beagles. Symptoms due to Bassa seemed to be augmented and length of intoxication extended with the increase of Bassa levels in blood by pretreatment with fenitrothion. However, a clear coincidence between the inhibition of cholinesterase activity and the augmentation of the acute oral toxicity was not seen. It is concluded that the synergistic action of fenitrothion and Bassa on beagles is weaker than that on mouse.

81-3214. Sawicki, B.; Kuczynski, M.; Mackowiak, J.; Derewonko, S. (Dep. Histol. & Embryol., Inst. Biostructure, Akad. Med., Bialstock PL-15089, Poland)

Histochemiczne badania wplywu fenchlorfosu (tiofosforanu O,O-dwumetylo-O- 2,4,5-trojchlorofenylu) na perfundowana watrobe szczura. [Histochemical studies of the effect of fenchlorfos (O,O-dimethyl-O- 2,4,5-trichlorophenyl thiophosphate) on the perfused liver of the white rat.] *Patol. Pol.* 32(1): 79-88; 1981 (19 references) (Polish).

Isolated, perfused white rat livers were treated with fenchlorfos (ronnel) at 7 mg/10 g liver tissue (0.66 LD50). Tissue samples were removed after 0, 15, 30 and 45 min of treatment. Routine histological staining procedures were carried out, in addition to analysis for glycogen, lipids and enzymes. It was concluded that the mechanisms for the effect of fenchlorfos on hepatocytes involves very marked inhibition of acetylcholinesterase activity, and to a significantly lesser degree the inhibition of the non-specific esterases.

81-3215. Hutson, D. H.; Graughan, L. C.; Casida, J. E. (Sittingbourne Res. Cent., Shell Toxicol. Lab., Shell Res. Ltd., Sittingbourne, Kent ME9 8AG, England) **Metabolism of the *cis*- and *trans*-isomers of cypermethrin in mice.** *Pestic. Sci.* 12(4): 385-398; 1981 (14 references).

Metabolism in mice of the separated *cis*- and *trans*-isomers of the pyrethroid insecticide cypermethrin (NRDC 149), (*RS*)-α-cyano- 3-phenoxybenzyl (1*RS*)-*cis,trans*-3-(2, 2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate, was investigated in each case with preparations that were ^{14}C-labelled in the benzyl and cyclopropyl moieties. Radioactivity from the *trans*-isomer was mainly excreted in the urine and that from the *cis*-isomer in the feces. Elimination of both isomers was rapid except for a small portion (approximately 2%) of the *cis*-isomer which was released from the fat with a half-life of approximately 13 days. Metabolism of cypermethrin occurred mainly by ester cleavage and elimination of the *cis*- and *trans*-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylic acid moieties as glucuronide conjugates. The α-cyano-3-phenoxybenzyl alcohol released by ester cleavage was mainly converted to 3-phenoxybenzoic acid which was partly eliminated unchanged, partly conjugated with aminoacids (mainly taurine) and glucuronic acid, and partly oxidized to 3-(4-hydroxyphenoxy)benzoic acid which was excreted as the sulfate conjugate. Metabolites retaining the ester linkage were formed by hydroxylation at various sites in the molecule with more hydroxylation of the *cis*- than of the *trans*-isomer occurring. (Author abstract by permission)

81-3216. Crawford, M. J.; Croucher, A.; Hutson, D. H. (Sittingbourne Res. Cent., Shell Toxicol. Lab., Shell Res. Ltd., Sittingbourne, Kent ME9 8AG, England) **The metabolism of the pyrethroid insecticide cypermethrin in rats; excreted metabolites.** *Pestic. Sci.* 12(4): 399-411; 1981 (14 references).

The metabolism of the pyrethroid insecticide cypermethrin has been studied in rats using 3 forms of ^{14}C-labelling (benzyl-, cyclopropyl- and cyano-) and separate *cis*- and *trans*- isomers. The production of the dose absorbed from the intestines (50-70% at 2-3 mg/kg) is rapidly metabolized and eliminated. The major reaction is cleavage of the ester bond to afford the constituent *cis*- and *trans*- acids which are conjugated with glucuronic acid and eliminated in the urine. The 3-phenoxybenzyl portion of the molecule is probably released as the α-hydroxynitrile, which is converted via the aldehyde into 3-phenoxybenzoic acid. This compound is then largely hydroxylated and eliminated as a sulfate conjugate. The cyanide ion is metabolized via predictable routes, for instance, as thiocyanate. Cypermethrin is hydroxylated to some extent before hydrolysis. Most of this hydroxylation occurs at the methyl group *trans* to the cyclopropane carboxyl group, and at the 4-position of the phenoxy group. *cis*-Cypermethrin is slightly more stable than the *trans*-isomer. (Author abstract by permission)

81-3217. Kanazawa, J. (Natl. Inst. Agric. Sci., 3-1, Kannondai, Yatebt Ibaraki, 305 Japan) **Measurement of the bioconcentration factors of pesticides by freshwater fish and their correlation with physicochemical properties or acute toxicities.** *Pestic. Sci.* 12(4): 417-424; 1981 (14 references).

The bioconcentration factors for 15 pesticides [BPMC, carbaryl, chlornitrofen, diazinon, dieldrin, EPN, fenitrothion, γ-HCH (lindane), IBP, leptophos, molinate, phenthoate, quintozene (PCNB), thiobencarb (benthiocarb) and trifluralin] by a freshwater fish (topmouth gudgeon) were measured under continuous flow conditions in water containing 5-20 μg/l of each pesticide at the equilibrium condition. A significant correlation was found between the BCF by the fish and the water solubility of the pesticide or its partition coefficient (PC) between octan-1-ol and water. Moreover, a significant correlation was also found between the BCF by topmouth gudgeon and the acute toxicities to carp, rainbow trout and water flea. It would therefore appear that the bioconcentration potential of a pesticide by a fish may be predicted from knowledge of its solubility or PC, and that the acute toxicity of a pesticide to a fish may be predicted from knowledge of the BCF. (Author abstract by permission)

81-3218. Mager, P. P. (Res. Group Pharmacochem., Med. Unit, Karl Marx Univ., DDR-7010 Leipzig, DDR) **Branching in structure-toxicity relationships applied to organophosphorus pesticides of the DDVP (dichlorvos) type: a novel phenomenon in QSAR.** *Pharmazie* 36(6): 448-449; 1981 (10 references).

As a means of developing safer organophosphorus derivatives, research has been conducted on quantitative structure-activity relationships (QSAR). Branching is

discussed, specifically with regard to dichlorvos (DDVP) type compounds. A regression analysis of variables, including oral toxicity and lipophilic substituent, was conducted. Theoretically calculated and experimentally obtained toxicity parameters for 38 compounds are compared.

81-3219. Mager, P. P. (Res. Group Pharmacochem., Med. Unit, Karl Marx Univ., DDR-7010 Leipzig, DDR) **Response surface optimization applied to neurotoxic organophosphorus poisons.** *Pharmazie* 36(7): 511-512; 1981 (14 references).

As an alternative to pharmacological tests to determine neurotoxic properties of organophosphorus poisons, a study of quantitative structure-toxicity relationships was presented. Because of the high multi-colinearity among the physicochemical parameters lipophilic substituent constant and molar refraction, a response surface optimization model was used to model neurotoxic action. The neurotoxicity of 22 compounds, including the nerve gas soman, was predicted.

81-3220. Mager, P. P. (Res. Group Pharmacochem., Karl-Mark-Univ., Leipzig, DDR) **Grouped observations in quantitative structure-toxicity relationships of organophosphorus poisons.** *Pharmazie* 36(7): 513-514; 1981 (16 references).

A method for predicting the toxicity of organophosphorus pesticides is described, and it is suggested that this may serve as a basis for development of safer pesticides. In the application of multicategorical data to structure-activity relationships, a serious problem arises. When observations are grouped because of clustering, the grouping effect is not uniform, but depends on the frequency distributions of the clusters. The author describes the use of the multicategorical QSAR to solve this problem. The formulae used are presented, and the structure-toxicity relationships applied to organophosphorus compounds are listed.

81-3221. Cecil, H. C.; Miller, R. W.; Corley, C. (Avian Physiol. Lab., Beltsville Agric. Res. Cent., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Feeding three insect growth regulators to white leghorn hens: residues in eggs and tissues and effects on production and reproduction.** *Poult. Sci.* 60(9): 2017-2027; 1981 (14 references).

Three insect growth regulators were fed to mature White Leghorn hens at dietary levels 1, 5, 10, and 50 times higher than the efficacy level for fly control. Feeding 10, 50, 100, and 500 ppm diflubenzuron; 2.5, 12.5, 25, and 250 ppm 6-azido-*N*-cyclopropyl-*N'*-ethyl-1,3,5-triazine-2,4-diamine (CGA-19255); and 50, 250, 500, and 2500 ppm 1-(8-methoxy-4, 8-dimethylnonyl) -4-(1-methylethyl) benzene (A13-36206) for 8 wk had no adverse effects on feed consumption, body wt, egg production, egg wt, egg shell thickness, fertility, hatchability, or progeny performance. Diflubenzuron and A13-36206 accumulated in the egg to levels approximately 0.04 and 0.004 of the dietary level, respectively, with a smaller accumulation in the liver and muscle. Diflubenzuron and A13-36206 accumulated in the body fat to levels approximately 0.10 and 0.02 of the dietary level, respectively. Five wk after withdrawal from the diet, diflubenzuron was not detectable in the egg, liver, fat, or muscle tissues of hens fed any level of the compound; however, hens fed the highest level of A13-36206 had residues of this compound in the body fat. Traces of A13-36206 were also found in the eggs of hens fed the 2 highest levels 5 wk after withdrawal. Residues of CGA-19255 were not detectable in the eggs, and the eggs were not analyzed for residues of the GCA-19255 metabolite, *N*-cyclopropyl-1,3,5-triazine-2,4,6-triamine (CGA-72662). However, very low levels of the CGA-72662 were found in the liver, body fat, and muscle, but CGA-72662 was not detectable in these tissues 1 wk after the withdrawal of CGA-19255 from the diet. (Author abstract by permission)

81-3222. Smith, W. D. L. (Employment Med. Advisor, Health & Safety Exec., Employment Med. Advisory Serv., Birmingham, England) **An investigation of suspected dinoseb poisoning after the agricultural use of a herbicide.** *Practitioner* 225(1356): 923-926; 1981 (11 references).

A case of suspected dinoseb poisoning is presented. A farmer was exposed to the herbicide while spraying his fields, and on the same day he experienced headache, malaise, lassitude, and sweating. On the following day he had some pyrexia (38.7°C). During the following 5 days he suffered from anorexia, intermittent sweating and shivering, chest and abdominal pain, excessive thirst, insomnia, wt loss, shortness of breath, and generalized yellowing of skin and sclera. Liver function was impaired, and chest x-rays revealed patchy areas of the lungs. His condition slowly improved; after 10-12 wk he had no symptoms, with the exception of a high blood urea.

81-3223. Tong, C.; Fazio, M.; Williams, G. M. (Naylor Dana Inst. Dis. Prev., Am. Health Found., Valhalla, NY 10595) **Rat hepatocyte-mediated mutagenesis of human cells by carcinogenic polycyclic aromatic hydrocarbons but not organochlorine pesticides.** *Proc. Soc. Exp. Biol. Med.* 167(4): 572-575; 1981 (34 references).

A mutagenesis assay in which human foreskin fibroblast culture was incubated with rat hepatocyte primary cultures and exposed to test substances is described. The organochlorine pesticides DDT, chlordane, and mirex were tested. Polycyclic aromatic hydrocarbons (PAH) were used as positive controls. 6-Thioguanine was used for the selection of hypoxanthine-guanine phosphoribosyl transferase (HGPRT) mutants in the fibroblast line. The PAH benzo(a)pyrene and 7,12-dimethyl-benz(a)anthracene were shown to be genotoxic in this system. DDT, chlordane, and mirex showed negative results. It is suggested than an epigenetic mechanism is responsible for the carcinogenicity of these pesticides.

81-3224. Hasegawa, H.; Sata, M.; Sudo, A.; Homma, T.; Miyagawa, M.; Suda, M.; Okonogi, K. (Natl. Inst. Ind. Health, Kawasaki, Kanagawa, Japan) **[Studies on intoxication due to methyl bromide (1) – biochemical change.]** *Sangyo Igaku Sogo-Kenkyusho Nempo (Ann. Rep. Natl. Inst. Ind. Health)* pg. 21; 1980 (Japanese).

Groups of rats were exposed to methyl bromide at concentrations of 50, 100, 150, and 200 ppm for 4 hr/day for 1 wk. Rats were sacrificed after 1 and 7 days of exposure, and clinical examination was carried out on blood, lung, heart, and liver. The concentration of methyl bromide in the blood showed a sigmoid increase in proportion to the concentration of methyl bromide in the air. Biochemical examination showed that the effect of methyl bromide was stronger in tissues taken after 1 day of exposure than in those taken after 7 days of exposure. The enzymic effects were most remarkable in blood (CPK, GOT, GPT, CHE) and in lungs (LDH, ACP).

81-3225. Sato, M.; Hasegawa, H.; Homma, T.; Miyagawa, M.; Suda, M.; Sudo, A.; Okonogi, K. (Natl. Inst. Ind. Health, Kawasaki, Kanagawa, Japan) **[Studies on intoxication due to methyl bromide (2) – distribution of methyl bromide and bromine in the living body.]** *Sangyo Igaku Sogo-Kenkyusho Nempo (Ann. Rep. Natl. Inst. Ind. Health)* pg. 22; 1980 (1 reference) (Japanese).

Rats were exposed to methyl bromide at a concentration of 400 ppm for 4 hr, and the distribution of methyl bromide and bromine in blood, liver, heart, kidney, and brain was determined. The concentration of methyl bromide in each tissue reached a fixed value 1 hr after the beginning of exposure. Methyl bromide disappeared from the tissue 1-2 hr after termination of exposure. The concentration of bromine in the tissue reached a maximum value 1-3 days after exposure. The metabolism of methyl bromide in the liver was found to be relatively rapid. Methyl bromide was concluded to invade the hypothalamus and corpus striatum of the brain.

81-3226. Homma, T.; Sudo, A.; Miyagawa, M.; Sato, M.; Hasegawa, H.; Suda, M. (Natl. Inst. Ind. Health, Kawasaki, Kanagawa, Japan) **[Studies on intoxication due to methyl bromide (3) – effects of methyl bromide on central nervous system.]** *Sangyo Igaku Sogo-Kenkyusho Nempo (Ann. Rep. Natl. Inst. Ind. Health)* pg. 22; 1980 (1 reference) (Japanese).

To investigate the mechanism of toxicity of methyl bromide in the central nervous system, rats were exposed to methyl bromide continuously for 24 hr or several wk, and changes in concentrations of neurotransmitters were examined. Methyl bromide affects concentrations of catecholamine, serotonin, acetylcholine and amino acids in the corpus striatum, hypothalamus, and midbrain. The changes in concentrations of the neurotransmitters is dependent on the concentration of methyl bromide. These changes are the same for short-term exposure to high concentrations and long-term exposure to low concentrations of methyl bromide.

81-3227. Miyagawa, M.; Hasegawa, H.; Sato, M.; Sudo, A.; Homma, T.; Suda, M. (Natl. Inst. Ind. Health, Kawasaki, Kanagawa, Japan) **[Studies on intoxication due to methyl bromide (4) – evaluation of toxicity of methyl bromide by conditioned taste aversion in rats.]** *Sangyo Igaku Sogo-Kenkyusho Nempo (Ann. Rep. Natl. Inst. Ind. Health)* pp. 23; 1980 (Japanese).

Rats with restricted water intake were administered an aqueous solution of saccharin. Rats were then exposed to methyl bromide at 25-400 ppm. After 3 days of exposure, a prejudiced preference test to the saccharin/water solution was carried out. Exposed rats showed an aversion reaction in proportion to the concentration of methyl bromide exposure; the reaction was observed even after the minimum exposure of 25 ppm for 4 hr.

81-3228. Saegusa, J.; Kawai, K.; Shimizu, S.; Miyazawa, H.; Karino, K. (Natl. Inst. Ind. Health, Kawasaki, Kanagawa, Japan) **[Pathological studies on intoxication due to 1,2-dibromo-3-chloropropane.]** *Sangyo Igaku Sogo-Kenkyusho Nempo (Ann. Rep. Natl. Inst. Ind. Health)* pg. 24; 1980 (Japanese).

1,2-Dibromo-3-chloropropane (DBCP) was administered sc to male rats at 10, 30, and 100 mg/animal. Various organs were examined. No abnormality was observed in the 10-ppm group. Slight denaturation and necrosis of the proximal kidney tubule epithelium were observed in the 30-mg group. In the 100-ppm group, pathologic signs similar to those that occur when DBCP is inhaled appeared in testes, kidney, and spleen; necrosis of lymphocytes, atrophy in thymus and lymph nodes, inhibition of cell division, and necrosis of intestinal villi were also observed. Denaturation of bronchial epithelial cells and necrosis occurred, without emphysematic changes that occur with inhalation of DBCP. It is concluded that DBCP is highly toxic to the nucleus, and its function is radiomimetic.

81-3229. Leighton, T.; Marks, E.; Leighton, F. (Dep. Microbiol. Immunol., Univ. California, Berkeley, CA 94720) **Pesticides: insecticides and fungicides are chitin synthesis inhibitors.** *Science* 213(4510): 905-907; 1981 (23 references).

Several important groups of fungicides and insecticides are specific inhibitors of chitin synthesis in a *Phycomyces* enzyme system and in insect organ cultures. The recently discovered benzoylphenylurea insecticides, which prevent chitin synthesis in insect tissues, are apparently not direct-acting chitin synthetase inhibitors. These insecticides may prevent insect chitin synthesis by interfering with the proteolytic activation of the chitin synthetase zymogen. (Author abstract by permission. Copyright 1981 by the American Association for the Advancement of Science)

81-3230. Fry, D. M.; Toone, C. K. (Dep. Avian Sci., Univ. California, Davis, CA 95616) **DDT-induced feminization of gull embryos.** *Science* 213(4510): 922-924; 1981 (17 references).

Injection of DDT into gull eggs at concentrations comparable to those found in contaminated seabird eggs in 1970 induces abnormal development of ovarian tissue and oviducts in male embryos. Developmental feminization of males is associated with inability to breed as adults and may explain the highly skewed sex ratio and reduced number of male gulls breeding on Santa Barbara Island in southern California. (Author abstract by permission. Copyright 1981 by the American Association for the Advancement of Science)

81-3231. Arakawa, Y.; Wada, O.; Yu, T. H. (Dep. Hyg. & Prev. Med., Fac. Med., Univ. Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan) **Dealkylation and distribution of tin compounds.** *Toxicol. Appl. Pharmacol.* 60(1): 1-7; 1981 (14 references).

By using gas chromatographic methods the present study was undertaken to determine whether the extent of the conversion of tetraalkyltins into trialkyltins in rabbits might be related to the length of their alkyl chain, and whether the signs of toxicity of tetra- and trialkyltins in rabbits might be associated with their distributions and accumulations in the tissues including the brain. Various tetraalkyltins (8.5 μmol) were administered iv to male rabbits and the quantity of tetra- and trialkyltins in organs was determined at varying intervals up to 3 hr after treatment. Tetraethyltin was quickly distributed to the liver whereas tetrapropyltin and tetrabutylin were slowly distributed. Tetraethyltin was more readily converted into the corresponding trialkyltin than tetrapropyltin, which, however, was more readily converted into trialkyltin than tetrabutyltin. About 20% of the tetraethyltin, 4% of the tetrapropyltin, and 1% of the tetrabutyltin were converted to the corresponding trialkyltins, respectively, within 3 hr after iv treatment. Thus, the extent of formation of trialkyltins decreased as the size and stability of the ligand increased. The distribution of 3 tetraalkyltins to the brain relative to the other organs was poor. The amounts of trialkyltin metabolites found in the brain, however, showed a tendency to increase with time. Particularly, the transfer of triethyltin to the brain was significant and this finding was compatible with the appearance of signs of toxicity. These results show that the extent of the dealkylation and the toxicity of alkyltin compounds depend on the length of their alkyl group, which was associated with the rate of absorption and ultimate distribution of alkyltin compounds. (Author abstract by permission)

81-3232. Scammell, J. G.; Fregly, M. J. (Dep. Physiol., Coll. Med., Univ. Florida, Gainesville, FL 32610) **The effect of 3-amino-1,2,4-triazole on hepatic and renal deiodination of L-thyroxine to 3,5,3′-triiodothyronine.** *Toxicol. Appl. Pharmacol.* 60(1): 45-51; 1981 (33 references).

An *in vitro* model has been employed to evaluate the effects of administration of aminotriazole (ATZ; amitrole) both *in vivo* and *in vitro* on the rate of outer-ring deiodination of thyroxine (T_4) to triiodothyronine (T_3) by 2000*g* supernatants of fresh hepatic and renal homogenates. Administration of ATZ (29 ± 1 mg/kg body wt/day) in the diet for 2 wk to male rats reduced hepatic and renal T_3 generation to 7 and 15% of control, respectively. This was associated with a significant depression of serum T_3 and T_4 concentrations. Administration of T_4 (50 μg/kg body wt/day) in combination with ATZ increased hepatic and renal T_3 generation to 135 and 182% of control levels, respectively. T_4 concentration in the serum of this group was significantly higher, while T_3 concentration was significantly lower, than in control rats. The addition of ATZ (10^{-2} or 10^{-4} *M*) to the incubation medium *in vitro* did not affect significantly the T_3 generation by control hepatic and renal homogenates. The results of this suggest that the action of ATZ on peripheral deiodination of T_4 may be indirect and secondary to inhibition of the synthesis of thyroid hormones and resulting hypothyroidism. (Author abstract by permission)

81-3233. Townsend, B. A.; Carlson, G. P. (Dep. Pharmacol. Toxicol., Sch. Pharm. & Pharm. Sci., Purdue Univ., West Lafayette, IN 47907) **Effect of halogenated benzenes on the toxicity and metabolism of malathion, malaoxon, parathion, and paraoxon in mice.** *Toxicol. Appl. Pharmacol.* 60(1): 52-61; 1981 (44 references).

The halogenated benzenes, inducers of xenobiotic metabolism, were studied for their effects on the metabolism of malathion, malaoxon (lindane), and paraoxon and on the toxicity and lethality of these organophosphorus insecticides and parathion. One mmol/kg of 1,4-dichlorobenzene (*p*-dichlorobenzene),

1,2,4-trichlorobenzene, 1,4-dibromobenzene, 1,2,4-tribromobenzene, or hexabromobenzene or 0.1 mmol/kg hexachlorobenzene was administered po to male mice daily for 7 days. In general, the trihalogenated benzenes increased the LD50 of all 4 insecticides 2- to 6-fold. These increases were larger than those observed with the di- or hexahologenated isomers. The bromide-substituted benzenes were usually more active than the chlorinated ones with the exception being hexabromobenzene. There was a good correlation between their effects on lethality and increases in *in vitro* carboxylesterase activity with either-malathion or malaoxon as the substrate. The trihalogenated benzenes decreased the inhibitory effect of malathion on cholinesterase activity in the brain and to a lesser degree in the red blood cells, but not in liver or plasma. There was also a good correlation between protection against parathion and paraoxon lethality, protection against inhibition of cholinesterase in the brain and liver by paraoxon, and increases in the dearlylation of paraoxon by microsomal mixed-function oxidases but not by hepatic or plasma esterases. It appears that the halogenated benzenes are able to protect against organophosphorus insecticide toxicity. With malathion increases in carboxylesterase activity may be important, and with paraoxon increases in microsomal mixed-function oxidase dearylation may play a role. Other changes such as in dealkylation and tissue binding cannot be excluded from contributing to the protection seen. (Author abstract by permission)

81-3234. Lock, E. A.; Scales, M. D. C.; Little, R. A. (Imp. Chem. Ind. Ltd., Cent. Toxicol. Lab., Nr Macclesfield, Cheshire SK10 4TJ, England) **Observations on 2′-chloro-2,4- dinitro-5′,6- di(trifluoromethyl) diphenylamine induced edema in the white matter of the central nervous system of the rat.** *Toxicol. Appl. Pharmacol.* 60(1): 121-130; 1981 (29 references).

Oral administration of the acaricide 2′-chloro-2,4-dinitro-5′,6′- di(trifluoromethyl) diphenylamine (CDTD) produced a dose-related, reversible, increase in the water content of the brain and spinal cord and a reversible increase in the water content of the optic nerve of the rat. The additional fluid was located in the white matter of the central nervous system. Animals given a single oral dose of 75 mg/kg developed hindlimb weakness 2-3 days after dosing which was associated with a greatly elevated cerebrospinal fluid pressure (CSFP). Administration of hypertonic urea (4.5 g/kg, sc) to rats showing hindlimb weakness improved their clinical condition and lowered CSFP. Although treatment reduced total brain water content, it did not appear to reduce the severity of the edema in the white matter. Associated with the increased intracranial pressure and marked swelling of the white matter a small increase in the activities of the lysosomal enzymes, *N*-acetyl-D-β-glucosaminidase and β-glucuronidase, was found in the optic nerve but not in the cerebellum of CDTD-treated rats, possibly as a result of sustained swelling and compression of the optic nerve. These studies have shown that CDTD produces a reversible edema of the white matter of the central nervous system of the rat and that the optic nerve appears to be particularly vulnerable, possibly due to the marked swelling leading to constriction at the optic foramen. (Author abstract by permission)

81-3235. Byrd, R. A.; Kimmel, C. A.*; Morris, M. D.; Holson, J. F.; Young, J. F. (Div. Teratogenesis Res., Natl. Cent. Toxicol. Res., Jefferson, AR 72079) **Altered pattern of prenatal toxicity in rats due to different treatment schedules with mirex.** *Toxicol. Appl. Pharmacol.* 60(2): 213-219; 1981 (13 references).

The effect of 2 slightly different treatment schedules on the pattern of mirex-induced prenatal toxicity was examined. Albino female rats were treated orally with 10 mg/kg mirex on gestation days 5-14 or 6-15 or with corn oil vehicle on days 5-15. All dams were killed on gestation day 20 and examined for early and late resorptions, late fetal deaths, and edematous fetuses. Mirex treatment on gestation days 5-14 produced a significantly higher incidence of total prenatal deaths than the day 6-15 treatment schedule. This difference was attributed to a fourfold higher incidence of late resorptions in the day 5-14 mirex group. The day 6-15 treatment schedule produced significantly more late fetal deaths than in the day 5-14 group. These data indicate that prenatal deaths occurred earlier and at a higher frequency among litters on the gestation day 5-14 mirex treatment schedule. However, when total prenatal deaths and edematous fetuses were combined to determine total affected, there was no difference between the 2 mirex treatment schedules. Furthermore, mirex treatment depressed net wt gain and produced lethality similarly in dams on both treatment schedules. Thus, the 2 mirex treatment schedules appear to alter the pattern and severity of prenatal toxicity but not the overall incidence of effect. These results demonstrate the importance of considering the specific endpoints (e.g., malformation, prenatal death, growth retardation, maternal toxicity) in response to a prenatal insult, as well as combining the various endpoints for an estimate of overall toxicity. (Author abstract by permission)

81-3236. Trush, M. A.; Mimnaugh, E. G.; Ginsburg, E.; Gram, T. E. (Lab. Med. Chem. & Biol., NCI, Natl. Inst. Health, Bethesda, MD 20205) ***In vitro* stimulation by paraquat of reactive oxygen-mediated lipid peroxidation in rat lung microsomes.** *Toxicol. Appl. Pharmacol.* 60(2): 279-286; 1981 (30 references).

Paraquat significantly stimulated lipid peroxidation in rat lung microsomes without the addition of exogenous iron. The ability of paraquat to stimulate this lipid peroxidation was dependent on the presence of adequate reducing equivalents (NADPH), aerobic conditions, and the duration of incubation, viz. optimal *in vitro* conditions. Even greater paraquat-mediated lipid peroxidation

was observed if incubations were conducted under O_2 or if vitamin E-deficient microsomes were utilized, factors which have previously been reported to increase the *in vivo* pulmonary toxicity of paraquat. Superoxide dismutase (3 μg/ml) significantly inhibited paraquat-stimulated lipid peroxidation in rat lung microsomes (73%), demonstrating a pivotal role for superoxide in this process. Thus, the redox cycling of paraquat and accompanying reactive oxygen generation was capable of mediating lipid peroxidation not only in mouse lung and rat liver microsomes but also in rat lung microsomes. (Author abstract by permission)

81-3237. Kluwe, W. M.; McNish, R.; Hook, J. B. (Cent. Environ. Toxicol., Michigan State Univ., East Lansing, MI 48824) **Acute nephrotoxicities and hepatotoxicities of 1,2-dibromo-3-chloropropane and 1,2-dibromomethane in male and female F344 rats.** *Toxicol. Lett.* 8(6): 317-321; 1981 (14 references).

Acute toxicity of 1,2-dibromoethane (EDB) and 1,2-dibromo-3-chloropropane (DBCP) to rats was investigated. Single ip injections of 40 mg/kg EDB or DBCP produced no demonstrable effects on serum GOT or GPT activities or blood urea nitrogen (BUN) concentration in male rats when thin slices of renal cortex were incubated in tetraethyl ammonium (TEA). TEA-slice-to-medium ratio (S/M) was not affected by single treatments with either EDB or DBCP; a decline in *p*-aminohippurate (PAH) S/M was noted 96 hr after treatment with DBCP. Repeated treatment with DBCP (4 doses) caused nephrotoxic damage in male rats at 40 mg/kg, but not at 10 mg/kg. Repeated treatment with 40 mg/kg EDB reduced the PAH S/M, but not the TEA S/M, and failed to increase BUN. Neither EDB nor DBCP treatment elevated serum GPT or GOT activities in male rate. Sex differences were slight. However, the EDB-induced decline in PAH S/M was noted only in males. Females responded to DBCP treatment with GPT and GOT elevations, while males did not.

81-3238. Hall, R. J.; Swineford, D. M. (Patuxent Wildl. Res. Cent., US Fish & Wildl. Serv., Laurel, MD 20811) **Acute toxicities of toxaphene and endrin to larvae of seven species of amphibians.** *Toxicol. Lett.* 8(6): 331-336; 1981 (10 references).

Specimens of 7 amphibian larvae were collected as eggs or larvae from several ponds and marshes at the Patuxent Wildlife Research Center. The species and numbers of animals tested included *Rana sphenocephala*, 290; *R. catesbeiana*, 200; *R. sylvatica*, 210; *Bufo americanus*, 700; *Acris crepitans*, 283; *Ambystoma opacum*, 203; and *A. maculatum*, 295. Technical-grade pesticides were injected into the test solutions in a continuous-flow dosing apparatus set up to produce 6 concentrations of toxicant. Measured concentrations were almost always lower than those intended, and they were generally lower than measured concentrations in earlier experiments. In 9 tests, toxaphene ranged from 17 to 74%. Endrin concentrations ranged from 36 to 84%, with an average of 63.4%. Acute lethality values for both chemicals tested on all species differed from values for chemicals tested on *R. sphenocephala* by < 1 order of magnitude, but behavioral effects differed more. These differences may be due to difficulty in interpreting observations. These findings cast doubt on the usefulness of continuous-flow toxicity tests for tadpoles. A water quality standard derived on the basis of tests with *R. sphenocephala* would protect many species of amphibians if a safety factor of 0.1 were used.

81-3239. Shigaeva, M. Kh.; Savitskaya, S. (Kazakh State Univ., Alma Ata, USSR) **Sravnitel'noe izuchenie mutagennoi aktivnosti nekotorykh fosfororganicheskikh insektitsidov na bakteriyakh. [Comparative study of the mutagenic activity of some organophosphorus insecticides in bacteria.]** *Tsitol. Genet.* 15(3): 68-72; 1981 (13 references) (Russian).

Mutagenic activity of the organophosphorus insecticides metaphos (methyl parathion), phosphamide (dimethoate), and carbophos (malathion) on the indicator *Salmonella typhimiruim* TA-1535 strain was shown by analysis of back mutations. All 3 preparations induced direct mutations in *Pseudomonas aeruginosa*. The number of visible mutations increased with prolongation of exposure time and insecticide concentration. Metaphos and phosphamide both induced auxotrophic mutations; phosphamide was more toxic. Phosphamide had the highest mutagenic activity in assays with bacterial systems.

81-3240. Verma, S. R.; Tonk, I. P.; Gupta, A. K.; Dalela, R. C. (Pollut. Relevant Res. Lab., Post grad. Dep. Zool., D.A.V. Coll., Muzaffarnagar 251001, India) **Role of ascorbic acid in the toxicity of pesticides in a fresh water teleost.** *Water Air Soil Pollut.* 16(1): 107-114; 1981 (15 references).

The effects of ascorbic acid and sublethal concentrations the pesticides Thiotox (thiram) and malathion on hematological parameters of a fish *Saccobranchus fossilis* were studied. Groups of 20 fish were kept in aquaria that provided 1 ℓ water/2 g body wt fish; water was renewed every 24 hr. Fish were exposed to Thiotox (0.002 mg/l) and malathion (5.2 mg/l), and received a diet every 3rd day containing 0 or 2 mg ascorbic acid/100 g body wt. Controls were not exposed to pesticide. Red blood cell (RBC) count, white blood cell (WBC) count, hemoglobin percentage (Hb%), clotting time (CT) packed cell volume (PCV), erythrocyte sedimentation rate (ESR), prothrombin time, mean corpuscular Hb (MCH) concentration, mean cell volume (MCV), glucose, plasma proteins, and various ion concentrations were determined after 15 and 30 days. Ascorbic acid alone, given in the diet, had little effect on these parameters. A significant change was observed for pesticide-exposed fish that were not given ascorbic acid. CT, MCH, and MCV decreased, while PT, Hb%, RBC,

WBC, glucose, P, NA, and chloride increased in pesticide-exposed fish. The changes were much less for pesticide-exposed fish given a diet with ascorbic acid, indicating that ascorbic acid played a protective role. Ascorbic acid may lead to greater degradation and elimination of these pesticides, which would explain its mitigating effect.

81-3241. WHO Expert Comm. Vector Biol. & Control **Resistance of vectors of disease to pesticides.** *WHO Tech. Rep. Ser.* 655: 82pp.; 1980 (19 references).

The WHO Expert Committee on Vector Biology and Control met during June of 1980 to consider the problem of resistance to pesticides of disease vectors. The present status of resistance was considered at it relates to mosquitos and other arthropods of public health or veterinary importance, nontarget organisms, and resistance in reservoirs and intermediate hosts of disease. The impact of pesticide resistance on the control of vectors and reservoirs of disease was considered, including malaria vectors in specific regions of the world, the impact on vectors of other diseases, and the impact on disease reservoirs such as rodents. Current research on resistance of vectors to pesticides, measures to counteract resistance, and the detection and monitoring of vector resistance to pesticides is reviewed.

81-3242. Horvath, E. P., Jr. (Marshfield Clin., Marshfield, WI 54449) **The Agent Orange controversy – physician's dilemma.** *Wis. Med. J.* 80(3): 16-18; 1981.

The controversy over the effects of Agent Orange (2,4-D + 2,4,5-T) and its contaminant TCDD are discussed. The toxicity of TCDD is reviewed. Agencies providing further assistance to concerned veterans are identified. TCDD has been shown to be mutagenic in 2 bacterial systems and resulted in chromosomal aberrations in rat bone marrow cells. Data on toxic effects of TCDD in humans is considered to be inadequate and controversial. An industrial accident in Nitro, West Virginia in 1949 exposed many workers to high levels of TCDD; no apparent excess of total mortality or deaths from malignant neoplasm has been noted in followup studies of these workers for 30 yr. A high miscarriage rate was noted following the spraying of 2,4,5-T around Alsea, Oregon. An increased incidence of liver cancer was report in Vietnam between 1974 and 1977 in areas sprayed with Agent Orange. Birth defects and chromosomal abnormalities have also been alleged. Chloracne is the most frequently occurring clinical manifestation. Hepatotoxicity with various increases in enzymes has been noted in some populations. Three regional Veterans Hospitals have been designated specifically for the examination of possible exposure cases. These hospitals can also supply the suggested procedures to a personal physician on request.

See also 81-3001, 81-3002, 81-3003, 81-3004, 81-3006, 81-3012, 81-3013, 81-3014, 81-3015, 81-3016, 81-3020, 81-3021, 81-3022, 81-3023, 81-3024, 81-3026, 81-3027, 81-3030, 81-3031, 81-3033, 81-3034, 81-3036, 81-3037, 81-3038, 81-3039, 81-3040, 81-3068, 81-3069, 81-3070, 81-3071, 81-3072, 81-3073, 81-3074, 81-3075, 81-3077, 81-3078, 81-3079, 81-3081, 81-3082, 81-3096, 81-3102, 81-3111, 81-3125, 81-3127, 81-3128, 81-3131, 81-3133, 81-3134, 81-3138, 81-3131, 81-3142, 81-3243, 81-3245, 81-3277 *and* 81-3285.

81-3243. Fishhein, L. (Dep. Human & Health Serv., Food & Drug Adm., Natl. Cent. Toxicol. Res., Jefferson, AR 72079) **Aspects of analytical toxicology related to analysis of pesticidal trace contaminants: an overview.** *ACS Symp. Ser.* 160(CH22): 349-385; 1981 (76 references).

Knowledge of the possible hazards of trace amounts of pesticides and their impurities, degradation products, and metabolites is increasing. There is a need for accurate analytical and toxicological methods to detect and quantify these agents as well as their biological and toxicological effects. GC/MS techniques have been useful. Thermal energy analysis and electrochemical detectors are also of great importance. Thermal energy analysis is particularly helpful in detecting trace levels of nitrosoamines and nitrosated pesticides in agricultural products and residues. Electrochemical detection coupled with HPLC is useful in determining halogenated anilines in biological and environmental samples.

81-3244. Horwitz, W. (Bur. Foods, US FDA, Washington, DC 20204) **Analytical measurements: how do you know your results are right?** *ACS Symp. Ser.* 160(CH24): 411-438; 1981 (21 references).

Since many important decisions affecting human health and welfare of must be based on the data from analytical results, the reliability and accuracy of this data must be ensured. The Commission of the European Communities has stated that quality control procedures should be required during the analysis of drinking water for impurities. Efforts to achieve reliability, accuracy and precision in a number of pesticide residue analyses in various substrates are reviewed. Analysts must recognize the need for quality control and participate voluntarily in intra- and interlaboratory checks to maintain it.

81-3245. McKinney, J. D.; Albro, P. W.; Cox, R. H.; Hass, J. R.; Walters, D. B. (Lab. Environ. Chem., Natl. Inst. Environ. Health Sci., Research Triangle Park, NC 27709) **Problems and pitfalls in analytical studies in toxicology.** *ACS Symp. Ser.* 160(CH25): 439-460; 1981 (39 references).

A brief outline of quality control criteria for analytical protocols is presented, with special focus on the analysis of pesticide residues for toxicological purposes. Sample preparation and cleanup is discussed, along with the use of blanks for quality control. Environmental analyses require the study of transformation products. The mechanisms of drug metabolism and metabolic activation are discussed, and the possibilities of predicting toxicity based on structure-activity data are considered. Epidemiological studies are useful in assessing the potential health hazard of various chemicals. Some limitations of currently used methods in pesticide residue analyses and toxicity tests are outlined. The monitoring of chemical residues in occupational environments to maintain safe working conditions is also considered.

81-3246. Sakaue, S.; Kitajima, M.; Horiba, M.; Yamamoto, S. (Inst. Biol. Sci., Sumitomo Chem. Co., Takarazuka, Hyogo 665, Japan) **Gas chromatographic and high performance liquid chromatographic determination of *d*-phenothrin (Sumithrin) in formulations.** *Agric. Biol. Chem.* 45(5): 1135-1140; 1981 (14 references).

, Gas chromatographic (GC) and high performance liquid chromatographic (HPLC) methods were developed for determination of a synthetic pyrethroid, 3-phenoxybenzyl *d-cis,trans*-chrysanthema (*s*-phenothrin, Sumithrin) in formulations, such as aerosol, dust, emulsifiable concentrate (EC), oil and premix, and also of coexisted other active ingredients. The active ingredients in formulations were determined by GC on a column of 2% DEGS using 2,2'-biquinoline as internal standard, and by HPLC on a column of μBondapak Phenyl with acetonitrile-water (3 + 2) as a mobile phase. Optical isomers of *d*-phenothrin were hydrolyzed to corresponding chrysanthemic acids, which were derivatized into diastereomer esters with *d*-2 or *l*-2-octanol and determined by GC on a glass capillary column of silicone DC QF-1. (Author abstract by permission)

81-3247. Knyr, L. L.; Sukhoparova, V. P. (IAP, Pushchino, USSR) **Opredelenie propanida, linurona, monolinurona, 3,4-dikhloranilina i 4-khloranilina v rastitel'nom materiale. [Determination of propanide, linuron, monolinuron, 3,4-dichloroaniline and 4-chloroaniline in plant material.]** *Agrokhimiya* (6): 127-131; 1981 (10 references) (Russian).

A method is proposed for photometric and chromatographic determination of the herbicides linuron, and monolinuron and their metabolites in plant tissues. The method is based on separate extraction of the compounds, purification of extracts from pigments on a column with zeolite, and photometric or chromatographic determination in a thin layer of sorbent.

81-3248. Zhemchuzhin, S. G. (Author address not given) **Metody analiza fenoksigerbitsidov. [Method of analysis of phenoxyherbicides.]** *Agrokhimiya* (6): 132-154; 1981 (222 references) (Russian).

Biological, physical, chromatographic, and chemical methods of determining 2,4-D, 2,4,5-T, 2M-4Kh (MCPB), silvex, dichlorprop, and 4(2,4-DB) were reviewed. There has been great interest for many years among analytical chemists, toxicologists, physiologists, and agrochemists in the problem of analysis of microquantities of phenoxyherbicides in agricultural products, biological

specimens, herbicide solutions, and environmental objects. The wide use of these herbicides in agriculture leads to concern about environmental pollution.

81-3249. Thomas, T. C.; Jackson, J. W.; Nishioka, Y. A. (USAF Occup. & Environ. Health Lab., Brooks AFB, TX 78235) **Chlordane sampling efficiency with Chromosorb 102 and ethylene glycol.** *Am. Ind. Hyg. Assoc. J.* 41(8): 599-601; 1980 (3 references).

The collection efficiency of Chromosorb 102 for chlordane was evaluated. A series of tests was conducted during which chlordane was volatilized from a small glass generator. The Chromosorb 102 tubes were packed with 0.2 g quantities of the polystyrene divinylbenzene copolymer. Collection efficiencies were evaluated over an approximate range of 0.01 to 20 times the present TLV for chlordane (0.5 mg/m³). The results of the study suggest that Chromosorb 102 be expanded in its use to the collection of chlordane from the air. The sampling tubes used would be efficient, inexpensive, and simply transported for field use.

81-3250. Berendsen, G. E.; Pikaart, K. A.; de Galan, L. (Lab. Anal. Chem., Delft Univ. Technol., 2600 GA Delft, The Netherlands) **(Heptadecafluorodecyl) dimethylsilyl bonded phase for reversed-phase liquid chromatography.** *Anal. Chem.* 52(12): 1990-1993; 1980 (8 references).

The synthesis and properties of a polyfluorinated chemically bonded phase for reversed-phase liquid chromatography are reported. This proposed stationary phase shows specific interaction with solutes containing fluorine atoms. Consequently, the perfluorocarbon bonded phase can be applied for the analysis of fluorine-containing pharmaceuticals, herbicides, and other chemicals. The perfluoro-bonded phase offers no improvement for the mutual separation of non-fluorine-containing compounds. In contrast, some improvement in selectivity toward fluorinated compounds is observed. However, a mixture of fluorine-containing compounds only can usually be separated on n-alkyl bonded phases as well as on RPF-10, providing that the mobile phase composition is optimized. The perfluorocarbon bonded phase displays its major strength in the separation of a fluorinated compound from its corresponding nonfluorinated analogue.

81-3251. Ryan, T. M.; Day, R. J.; Cooks, R. G.* (Dep. Chem., Purdue Univ., West Lafayette, IN 47907) **Secondary ion mass spectra of diquaternary ammonium salts.** *Anal. Chem.* 52(13): 2054-2057; 1980 (5 references).

Molecular dications emitted by momentum transfer processes are observed in secondary ion mass spectra (SIMS) of diquaternary ammonium salts. The relationship between molecular structure and the observation of dications is explored. Large interchange separations, corresponding to lessened intramolecular coulombic repulsions, are observed to correlate with dication detection. Fragmentation with charge separation is facilitated by small interchange distances and can preclude observation of the dication. Electron attachment to yield the monocation is an alternative to dication emission when the structure of the dication facilitates reduction. This occurs, for example, for the herbicide diquat (*N,N'*-ethylene-2,2'-bipyridyl dibromide) which is detected as its monocation. Complete spectra of diquaternaries can be taken with ng size samples. (Author abstract reprinted by permission of the American Chemical Society)

81-3252. Mangani, F.; Crescentini, G.; Bruner, F.* (Ist. Sci. Chim., Univ. Urbino, I-6-61029 Urbino, Italy) **Sample enrichment for determination of chlorinated pesticides in water and soil by chromatographic extraction.** *Anal. Chem.* 53(11): 1627-1632; 1981 (9 references).

The use of Carbopack B columns to recover chlorinated pesticides from water is discussed in terms of recovery and elution curves. The same principles apply for the extraction of chlorinated pesticides from soil. The method presented uses small solvent volumes and saves time. Pesticides used were lindane, β-BHC, heptachlor, aldrin, endosulfan I, *p,p'*-DDE, dieldrin, *o,p'*-TDE, *p,p'*-DDT and methoxychlor. (Author abstract reprinted by permission of the American Chemical Society, modified)

81-3253. Parker, R. T.; Freedlander, R. S.; Dunlap, R. B.* (Dep. Chem., Univ. South Carolina, Columbia, SC 29208) **The development of room temperature phosphorescence into a new technique for chemical determinations. Part 2. Analytical considerations of room temperature phosphorimetry.** *Anal. Chim. Acta* 120: 1-17; 1980 (54 references).

The rapidly developing technique of room temperature phosphorimetry is discussed from a practical analytical standpoint. Basic factors concerning the technique such as methods of sample preparation, special instrumentation employed, and quantitative capability are presented, together with a listing of the variety of organic compounds reported to display room temperature phosphorescence (including several fungicides). Potential applications of room temperature phosphorimetry and the advantages of sensitivity and selectivity afforded by this technique are discussed. (Author abstract by permission, modified)

81-3254. Scudamore, K. A. (Minist. Agric. Fish. & Food, Slough Lab., Slough, Berkshire SL3 7HJ, England) **Determination of 2-aminobutane in potatoes using high-performance liquid chromatography.** *Analyst (London)* 105(1257): 1171-1175; 1980 (7 references).

Development work on the use of 2-aminobutane (sec-butylamine) to control certain potato-tuber diseases necessitated the development of a convenient and sensitive analytical method for residue determination. The amine was distilled from potatoes, dansylated and determined using reversed-phase high-performance liquid chromatography with fluorescence detection. Recovery of 2-aminobutane by distillation was about 95% from standard solutions and 92% from treated potatoes. The lower limit of detection is below 0.2 μg/kg. (Author abstract by permission)

81-3255. Kettrup, A.; Maasfeld, W. (Dep. Chem., Univ. Paderborn, D-4790 Paderborn, BRD) **Determination of phenylurea herbicides and their metabolites by high performance liquid chromatography.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 197-201; 1980 (7 references).

Reversed-phase high-performance liquid chromatography was demonstrated as a powerful tool for the simultaneous separation and determination of several herbicides. The determination of methabenzthiazuron (MBT: AI of Tribunal) and its metabolites was used as the example. MBT is degraded in plants to N-hydroxymethyl-N'-methyl-N'(2- benzothiazolyl) urea and to N'-methyl-N'-(2-benzothiazolyl) urea. High performance liquid chromatography was able to separate these chemicals in a simultaneous determination.

81-3256. Soulier, J.; Farines, M.; Vicens, G. (Lab. Org. Chem., Cent. Univ. Perpignan, F-66025 Perpignan, France) **Microanalysis of aminotriazole by high performance liquid chromatography.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 203-209; 1980 (28 references).

An analytical method for the detection of aminotriazole (amitrole) is described which is more sensitive than previously described methods, is highly specific, and is easy and rapid and is less susceptible to errors or losses during handling. The method calls for the preparation of a derivative of aminotriazole by adding an excess of nitrous acid to an aqueous solution of aminotriazole acidified to pH 2.5 to 3 by acetic acid. This derivative has an absorption maximum for HPLC at 254 nm and a fair retention time. Extracting the sample from clayey soil calls for preparation of the extraction solvent by mixing acetonitrile with water and aqueous ammonia. The solvent is mixed with the soil sample, centrifuged, mixed, and centrifuged again. Aqueous extracts are mixed and ammonia slowly boiled out. The pH is adjusted to 6 to flocculate the extracted clay. After filtering, the filtrate is concentrated under reduced pressure. Extraction from vine leaves is also described using acetonitrile as the extracting solvent. The minimum quantity of aminotriazole giving a peak corresponding to 2.5% of full scale is 5 ng.

81-3257. Budde, W. L.; Eichelberger, J. W. (Environ. Monit. Support Lab., US EPA, Cincinnati, OH 45268) **Design of the organics analysis in an environmental monitoring system.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 307-316; 1980 (3 references).

The selection of analytical methods for use in environmental monitoring systems is discussed. Major considerations are the target compound, reproducibility of results, and cost. The US EPA's priority pollutant program is discussed. An example is provided of selecting the correct method for the job required. During 1976 the EPA began a program to establish for industrial wastewater effluent limitations for a group of 129 pollutants and to recommend treatment technology to meet these limitations. The 26 compounds listed in the pesticide group are extracted from a sample at ambient pH with 15% methylene chloride in hexane. They are initially detected by gas chromatography with an electron capture detector, but must be confirmed by GC/MS.

81-3258. Beggs, D. P. (Hewlett-Packard Co., Palo Alto, CA 94304) **Automatic analysis of organic pollutants in water via a calculator-controlled GC/MS.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 317-324; 1980 (3 references).

The use of a low cost microcomputer-controlled gas chromatograph/mass spectrometer to automatically carry out the routine analysis of water samples or extracts of water samples is presented. The system greatly simplifies the analysis and reduces the need for operator attention. The instrument accepts raw water samples for the analysis of purgeable organic compounds, acid extracts, base/neutral extracts, and pesticides. Subsequent analysis and data reduction are carried out under control of the calculator. The analysis of purgeable organic compounds in water is semi-automatic. The operator is required only to insert the water sample and answer 4 questions asked by the calculator. Sampling and analysis are completely controlled by the calculator. Analysis of non-purgeable organic compounds can be carried out in this manner, but the liquid-liquid sampling procedure is not automated. Subse-

quent analysis and data reduction are carried out under control of the calculator.

81-3259. Mindrup, R. (Supelco Inc., Bellefonte, PA 16823) **Trace analysis of organics in water by gas chromatography.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 325-333; 1980 (4 references).

Column technology required for the separation of 114 organic water pollutants proposed for study by the EPA is described. The procedure calls for the separation of volatiles, semi-volatiles, basic, acidic, and pesticides, each of which required a specific extraction technique and column technology. Pesticides are extracted from water with methylene chloride, distilled in glass, and separated on a 1% SP-2250 column. While the resolution of the pesticides is limited on the 6 ft (1.82 m) × 2 mm ID glass column containing 1% SP-2250 on 100/120 Supelcoport, they are differentiated from PCBs. Chlordane and toxaphene show multiple isomer peaks and elute after the other pesticides.

81-3260. Stieglitz, L.; Roth, W. (Inst. Heisse Chem., Kernforschungszentrum, Karlsruhe, BRD) **Application of an element specific microwave plasma detector to the identification and quantification of micropollutants in water.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 345-352; 1980 (10 references).

The application of combined gas chromatography-microwave plasma detection toward the analysis of organic micropollutants in water is discussed. Eleven elements can be monitored simultaneously in the effluent from a gas chromatograph. The amount of material required for analysis is about 100 ng. The detector is applied to the identification of pollutants in surface water samples. In this study chloroform, trichloroethylene, tetrachloroethylene, *p*-dichlorobenzene, and hexachlorobutadiene were found in concentrations from 100-300 ng/l. In combination with low resolution mass spectrometry, the knowledge that heteroatoms such as sulfur, oxygen, and nitrogen are present is helpful in the interpretation of mass spectra.

81-3261. Fleet, B. (HSA Reactors Ltd., Rexdale, Ontario, Canada) **Recent advances in electrochemical techniques for environmental pollution monitoring and control.** In: *Analytical Techniques in Environmental Chemistry*. Albaiges, J., ed. (Pergamon Press: Oxford): 3: 589-600; 1980 (37 references).

The current status of electrochemical sensors for pollution monitoring is reviewed. A survey of electroanalytical techniques and a comparison with competitive instrumental techniques in terms of selectivity, sensitivity, and economics is presented. The main types of pollutant species, toxicity, and permissible regulatory levels are discussed. New approaches to the problem of effluent control based on electrochemical reactor systems are considered. Modern polarographic methods, pulse techniques, differential pulse polarography, stripping voltammetry, and hydrodynamic voltammetry are discussed.

81-3262. Dougherty, R. C.; Wander, J. D. (Dep. Chem., Florida State Univ., Tallahassee, FL 32306) **Chloride attachment negative chemical ionization mass spectra of organophosphate pesticides.** *Biomed. Mass Spectrom.* 7(9): 401-404; 1980 (5 references).

The dichloromethane-mediated negative chemical ionization mass spectra of 17 organophosphorus pesticides are presented. The chemicals studied included dimethoate, chloromephos, thiometon, formothion, demeton-O, phorate, disulfoton, methidathion, phosmet, azinphos-methyl, mecarbam, carbophenothion, phosalone, phencapton, ethion, dialifor, bensulfide, and dioxathion. The methylene chloride NCI mass spectra proved to be dominated by ions resulting from dissociative capture to give thiophosphate or phosphate anions and by chloride attachment ions. The latter ions would allow for unequivocal identification of the pesticide in residue screening applications.

81-3263. Dougherty, R. C. (Dep. Chem., Florida State Univ., Tallahassee, FL 32306) **Negative chemical ionization mass spectrometry: applications in environmental analytical chemistry.** *Biomed. Mass Spectrom.* 8(7): 283-292; 1981 (23 references).

The use of negative chemical ionization (NCI) screening for xenobiotic chemicals in environmental substrates has suggested widespread contamination of the general population with polychlorophenols, PCBs, polychloronaphthalenes, and tris-(1,3-dichloro-2-propyl)phosphate. Originally, NCI screening of environmental substrates called for extracting of a sample of human urine (buffered to pH 6) with with methylene chloride, drying the extract, and evaporating the solvent before examining the residue by direct probe NCI mass spectrometry. Various clean-up procedures for urine and other specific substrates have now been instituted to extend source life, the most common one being steam distillation with continuous liquid-liquid extraction. Male fertility patterns have been extensively studied using NCI techniques in efforts to determine factors responsible for the abrupt decline in male fertility in the United States. Study results suggest that the concentrations of xenobiotics/cell correlate negatively with sperm densities. Results for trichlorophenol, pentachlorophenol (PCP), pentachlorobiphenyl, hexachlorobiphenyl and tris-(1,3-dichloro-2-propyl)phosphate are presented.

81-3264. Pickova, J.; Prerovska, I. (Clin. Occup. Dis., Univ. Hosp. & Clin. Natl. Health Inst., Prague Natl. Comm., Prague, Czechoslovakia) **Stanoveni paraquatu a diquatu v biologickem materialu. [Paraquat and diquat estimation in biological material.]** *Cas. Lek. Cesk.* 120(25): 774-776; 1981 (12 references) (Czech).

The procedural indicators of Calderban's analytical method for determining paraquat and diquat involving the absorption of bipyridyls by a cation-exchange resin and their colorimetric determination in the eluate were adapted to the use of the cation-exchange resin Ostion KS. The method involved determining the relationship of paraquat and diquat absorption and elutriation on the catex quantity used, choosing a suitable elutriation agent, and determining the dependence of color intensity on time, the reducing agent, and the alkalinity of the solution. The findings were verified by applying the adapted method to blood and urine of 4 patients poisoned by exposure to Gramoxone (paraquat) and Reglone (diquat) sprays. Concentrations of 0.1 mg paraquat and 0.5 mg diquat in 1 m^3 air are considered to be safety thresholds for exposed personnel.

81-3265. Kostowska, B.; Piasecka-Grzeszek, A.; Sadowski, J. (Dep. Ecol. & Weed Control., Inst. Soil Sci. & Cultivation Plants, Wroclaw, Poland) **Oznaczanie pozostalosci α,α,α-trojfluoro- 2,6-dwunitro-N,N-dwupropylo-p-toluidyny (trifluraliny) w ziarnie i slomie rzepaku oraz glebie. [Determination of α,α,α-trifluoro-2,6-dinitro-N,N- dipropyl-p-toluidine (trifluralin) residues in rape grain, rape straw, and soil.]** *Chem. Anal. (Warsaw)* 25(6): 1105-1108; 1980 (1 reference) (Polish).

A method for the determination of trifluralin in rape grain, rape straw, and the soil is described. After extraction with methanol and dilution with water, trifluralin was reextracted with hexane. The extract was purified on a column packed with aluminum oxide, then analyzed by gas chromatography using electron capture detection. The recovery using this method is 75-90%, the limit of determination 0.015 ng, and the limit of detection 0.002 mg/kg.

81-3266. Bonham, J. R.; Gowenlock, A. H.; Timothy, J. A. D. (Dep. Clin. Biochem., Newcastle Gen. Hosp., Newcastle on Tyne NE4 6BE, England) **Acetylcholinesterase and butyrylcholinesterase measurement in the pre-natal detection of neural tube defects and other fetal malformations.** *Clin. Chim. Acta* 115(2): 163-170; 1981 (15 references).

The measurement of acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) in amniotic fluid is described as a method for the pre-natal detection of neural tube defects. The enzymes were measured by reaction rate methods. AChE was measured in a cuvette containing 2.55 ml of 100 nmol/l phosphate buffer (pH 8.0), 50 μl of 852 μmol/l Lysivane (a selective inhibitor of BChE), 100 μl of 10 nmol/l DTNB in 100 nmol/l phosphate buffer (pH 7.0), and 200 μl amniotic fluid. BChE was measured in a cuvette containing 2.7 ml of 100 mmol/l phosphate buffer (pH 8.0), 100 μl of 10 mmol/l DTNB in 100 nmol/l phosphate buffer (pH 7.0), and 100 μl amniotic fluid. This method was concluded to be more specific than previously reported assays.

81-3267. Katkar, H. N.; Joglekar, V. D. (Forensic Sci. Lab., Maharashtra, Bombay 400008, India) **Specific chromogenic reagent for the identification of endrin on T.L.C.** *Curr. Sci.* 49(9): 350-351; 1980 (5 references).

Stannous chloride in 50% hydrochloric acid followed by aqueous basic fuchsin dye solution is reported for the thin layer chromatography detection of endrin in formulations as well as in biological materials obtained in cases of endrin poisoning. The reagent is specific for endrin, and sensitive at 5 μg concentrations. No interference was found from other insecticides. The chromatogram was developed with solvent mixture hexane:acetone (9:1) and hexane. The plate was air-dried and sprayed with stannous chloride reagent. A greenish-blue spot was observed for endrin.

81-3268. Sane, R. T.; Kamat, S. S. (Dep. Chem., Ramnarain Ruia Coll., Matunga, Bombay 400019, India) **Colorimetric determination of endrin in biological materials.** *Forensic Sci. Int.* 18(1): 63-66; 1981 (5 references).

The application of a simple colorimetric method for the determination of endrin residues in biological specimens is described. Endrin is extracted using diethyl ether, and is further processed by passage through a magnesium oxide-celite column. The extracted endrin is treated with sodium perborate, formaldehyde, and sulfuric acid. The intensity of the color is measured at 405 nm. In the tests performed, endrin was recovered at levels of 97-102.3% from viscera, blood, stomach contents, and urine samples.

81-3269. Lechien, A.; Valenta, P.; Nuernberg, H. W.*; Patriarche, G. J. (Inst. Chem., Inst. Appl. Phys. Chem., Nucl. Res. Cent., Juelich, BRD) **Differential pulse polarography of some herbicides derived from 2,4-dichlorophenoxyacetic acid. I. Nitration and polarographic behavior of the resulting nitro-derivatives.** *Fresenius Z. Anal. Chem.* 306(2-3): 150-155; 1981 (17 references).

Four herbicides derived from 2,4-dichlorophenoxyacetic acid (2,4-D) were nitrated in order to make them amenable to polarographic determination. The optimal conditions for the nitration procedure (contents of nitrating mixture, nitration time, temperature) and the pH of the supporting electrolyte were investigated in detail not

only to obtain a high determination sensitivity between 40 and 80 μg/l depending on the compound but also to improve the selectivity of the method. (Author abstract by permission)

81-3270. Lechien, A.; Valenta, P.; Nuernberg, H. W.; Patriarche, G. J. (Inst. Chem., Inst. Appl. Phys. Chem., Nuclear Res. Cent., D-5170 Juelich, BRD) **Differential pulse polarography of some herbicides derived from 2,4-dichlorophenoxyacetic acid.. II. Determination of herbicide residues in irrigation waters.** *Fresenius Z. Anal. Chem.* 306(2-3): 156-160; 1981 (11 references).

A method has been developed for the differential pulse polarographic determination of 2,4-D, 2,4-DP, MCPA and MCPP (mecoprop) residues in irrigation waters. The method involves a chloroform extraction of acidified water samples, back extraction into alkali solution and a further extraction of the acidified residue into chloroform. Subsequently, the residues are nitrated and the herbicide concentration is determined by differential pulse polarography. The determination limits of the method were found to be 30 μg/l for 2,4-D and MCPA and 40 μg/l for 2,4-DP and MCPP. (Author abstract by permission)

81-3271. Specht, W.; Tillkes, M. (Lab. Ruckstandsanalytik, St. Anscharplatz 10, D-2000 Hamburg 36, BRD) **Gas-chromatographische bestimmung von Ruckstanden an pflanzenbehandlungsmitteln nach clean-up uber gel-chromatographie und mini-kieselgel-saulen-chromatographie. [Gas-chromatographic determination of pesticide residues after clean-up by gel-permeation chromatography and mini-silica gel-column chromatography.]** *Fresenius Z. Anal. Chem.* 307(4): 257-264; 1981 (11 references) (German).

The gas chromatographic determination of 11 herbicidal phenoxyalkyl acids and their esters and conjugates in plant material is described. The process includes: alkaline hydrolysis, extraction of the acids by acetone/water/dichloromethane partition, gel permeation chromatography, acid/base distribution, methylation with methanol/sulfuric acid, and detection by gas chromatography/mass fragmentography. Additional cleanup of the methyl ester solutions by mini-silica gel-column chromatography is necessary before the electron-capture gas-chromatographic determination of 2,4-D, 2,4-DB, dichloroprop, diclofop methyl, fenoprop (silvex) and 2,4,5-T.

81-3272. Shcherbina, O. N.; Kramarenko, G. V.; Popova, V. I.; Kvartnik, V. M. (Med. Inst., Lvov, USSR) **Kolichestvennoe opredelenie Kotorana. [Quantitative analysis of Cotoran.]** *Gig. Tr. Prof. Zabol.* (6): 54-55; 1981 (5 references) (Russian).

A photoelectrocolorimetric method for the determination of Cotoran (fluometuron) is presented. Formation of a colored compound occurs during interaction of the product of alkaline hydrolysis of this preparation with a HCl solution of π-dimethyl-aminobenzaldehyde. Azorhodanine formation is also used, involving: hydrolysis of Cotoran, subsequent diazotization of the primary aromatic amine (trifluoromethylalanine), and combination of the diazonium salt with 3-(α-γ-dicarboxypropyl) -rhodanine. The detection limit of the method is 8 μg/ml. The precision is 1.65%.

81-3273. Ehrlich, B. J. (Tracor Inc., Austin, TX) **Improved detection of N- and P-compounds after GC separation.** *Ind. Res. Dev.* 22(4): 107-110; 1980 (14 references).

A nitrogen/phosphorus detector (NPD) was developed in 1977 to improve performance of a flame ionization detector for the identification of organic compounds containing nitrogen or phosphorus. Tests were performed operating the NPD with several different alkali sources. Initial injections were 4 μl of a mixture of 4×10^{-9} g atrazine, 2×10^{-9} g methyl parathion, and 4×10^{-6} g of C20 hydrocarbon in a hexane matrix. Response was measured in terms of peak height at constant retention time. Using the peak area, calculations were made of minimum detectable level and selectivity.

81-3274. Lawrence, J. F.; Panopio, L. G.; McLeod, H. A. (Food Res. Div., Food Dir., Health Prot. Branch, Tunney's Pasture, Ottawa, Ontario K1A OL2, Canada) **Comparison of liquid and gas chromatography for the determination of bromoxynil octanoate and benzoylprop ethyl in wheat products.** *J. Agric. Food Chem.* 28(5): 1019-1022; 1980 (10 references).

Wheat products, including whole grain wheat, shredded wheat cereal, whole wheat flour and bread, and refined white flour and bread were blended with methanol to extract bromoxynil octanoate {[(3,5-dibromo- 4-octanoyl)oxy]benzonitrile} and benzoylprop ethyl [ethyl *N*-(3,4-dichlorophenyl) -2-aminopropionate] from the samples. An aliquot of the extract was partitioned between methylene chloride and water. The organic extract was reduced to a small volume and passed through a 3% deactivated Florisil column. The fraction containing the herbicides was analyzed by both gas (GC) and liquid (LC) chromatography. Detection limits in the samples were about 0.05 ppm by LC and about 0.005 ppm by GC. Recoveries were generally higher than 80% by both LC and GC at 0.1 ppm or greater. (Author abstract reprinted by permission of the American Chemical Society)

81-3275. Maiorino, R. M.; Whiting, F. M.; Brown, W. H.; Reid, B. L.; Stull, J. W. (Dep. Anesthesiol., Univ.

Arizona, Tuscon, AZ 85724) **Quantitative determination of toxaphene in blood by Florisil extraction and gas chromatography.** *J. Anal. Toxicol.* 4(4): 192-198; 1980 (17 references).

An improved method for the determination of toxaphene in bovine defibrinated whole blood (DWB) is presented. The method consists of a Florisil column extraction technique in conjunction with GLC/ECD; 2 ml distilled water was added to the DWB to maintain constant volume throughout the procedure. The water decreased emulsification and significantly increased toxaphene recovery. Elimination of potassium carbonate treatment and replacement of 97% formic acid with 88% formic acid greatly reduced early background interference. The column extraction procedure was able to combine extraction and cleanup in one step. This method appears to release toxaphene without degradation, and GLC/ECD interference from lipid, protein, and heme materials is minimized. Problems of duration of mixing, emulsion formation, and binding of pesticides to blood constituents are minimized. The method may also be applicable to other pesticides in whole blood.

81-3276. Bakry, N. M.; Abou-Donia, M. B.* (Dep. Pharmacol., Duke Univ. Med. Cent., Durham, NC 27710) **Sequential thin-layer chromatography of phosfolan, mephosfolan and related compounds.** *J. Anal. Toxicol.* 4(4): 212-215; 1980 (17 references).

A rapid sequential thin-layer chromatographic (STLC) method is presented for the sensitive and specific analyses of phosfolan and mephosfolan and some of their metabolites. The Instant Thin Layer Chromatography (Gelman type SA) silicic acid-impregnated glass fiber sheets were first developed up to 6 cm with the primary solvent 2-butanone-1-butanol-water (9:3:1), then after drying, to 16 cm with the secondary solvent acetonitrile-n- hexane-benzene-acetic acid (80:40:40:1). This 2-solvent sequential system separated each insecticide from its corresponding metabolites. The R_f values were: phosfolan, 0.69; ethylene dithioimidocarbonate hydrochloride, 0.08; ethylene dithiocarbonate, 0.90; potassium thiocyanate, 0.40; mephosfolan, 0.76; o,o-dimethyl 4-hydroxymethyl-1,3-dithiolan-2-amidate, 0.83; propylene dithioimidocarbonate hydrochloride, 0.15; and propylene dithiocarbonate, 0.87.

81-3277. Krull, I. S.; Mills, K.; Hoffman, G.; Fine, D. H. (Inst. Chem. Anal., Northeastern Univ., Boston, MA 02115) **The analysis of *N*-nitrosoatrazine and *N*-nitrosocarbaryl in whole mice.** *J. Anal. Toxicol.* 4(5): 260-262; 1980 (18 references).

A method for biosynthesis and recovery of *n*-nitrosoatrazine and *N*-nitrosocarbaryl from whole mouse is described. Swiss CD-1 mice were fasted 16 hr prior to experimentation. For biosynthesis studies, mice were administered these substances by gavage: atrazine (250-1000 μg/250 μl EtOH:HOH) followed within 20-30 sec by sodium nitrite (250-500 μg/250 μl HOH), and, at the end of specified time periods, sodium ascorbate (100 mg/ml HOH). For recovery studies, N-nitrosoatrazine (NATR) (500 ng/250 μl EtOH) was used instead of the atrazine and sodium nitrite solutions. Mice were sacrificed by freezing in liquid nitrogen and homogenizing; an acetonitrile extract of the homogenate was dried, and the residue analyzed in an appropriate solvent by high pressure liquid chromatography interfaced to a Thermo Electron Analyzer. The recoveries of NATR and N-nitrosocarbaryl (NCARB), administered to the mice separately or together by gavage and analyzed at zero time, were similar. NCARB represented an ideal internal recovery standard for NATR. For *in vitro* experiments, about 0.4% of the added atrazine was converted to NATR. The results were erratic for the *in vivo* experiments. At the highest gavage levels, NATR was detected at all times after gavage with the amount of NATR present increasing with time, even up to 15 min. At 500 μg atrazine-500 μg nitrite, NATR was found in some mice, but the data were scattered. At 250 μg atrazine-500 μg nitrite, NATR was not detected, even with a limit of detection of 0.010 μg NATR. This method is sensitive to 0.004% conversion of atrazine to N-nitroso atrazine. This high sensitivity enables a compound to be tested at a concentration close to its expected environmental level.

81-3278. Jensen, T. L. (Nebraska Dep. Agric. Lab., Lincoln, NE 68502) **Gas-liquid chromatographic determination of disulfoton in formations: collaborative study.** *J. Assoc. Off. Anal. Chem.* 63(4): 869-873; 1980 (5 references).

A rapid method is described for the determination of disulfoton (*O,O*-diethyl *S*-[2-(ethylthio) ethyl] phosphorodithioate) in formulations by gas-liquid chromatography (GLC). Samples are dissolved in acetone, and after an internal standard is added, the samples are diluted to volume with solvent. They are then injected into a gas chromatograph equipped with a flame ionization detector and quantitated by peak height or area measurements. Fourteen collaborators made duplicate determinations on 4 samples including the technical product, a liquid, and 2 granular formulations. The average coefficient of variation was 0.847% for the liquid samples and 1.90% for the granules. The method has been adopted as official first action. (Author abstract by permission)

81-3279. Kawano, Y.; Chang, W. (Agric. Biol. Chem. Dep., Coll. Trop. Agric. & Hum. Resour., Univ. Hawaii, Honolulu, HI 96822) **Spectrophotometric determination of Rozol in paraffinized formulations.** *J. Assoc. Off. Anal. Chem.* 63(5): 996-998; 1980 (4 references).

Rozol (2-[(*p*-chlorophenyl) phenylacetyl]-1, 3-indandione; chlorophacinone) in paraffinized baits is extracted with benzene. The extract is placed on a Florisil col-

umn. Paraffin and other interfering substances are removed by washing with benzene, carbon disulfide, and hexane. Rozol is eluted with acidic ethanol. The eluate is analyzed with a UV spectrophotometer by scanning between 360 and 240 nm and measuring the absorbances at 350 and 321 nm. The amount of Rozol is calculated by comparison with a standard, and a correction is made from the recovery of a fortified sample. Recoveries from fortified samples averaged 93.7%. The linearity of measurement of Rozol at 321 nm ranged from 2 to 10 μg. (Author abstract by permission)

81-3280. Meier, J.; Nowak, K.; Suter, R.; Tomann, A.; Bosshardt, H. P. (Ciba-Geigy Ltd., CH-4002 Basel, Switzerland) **Gas-liquid chromatographic determination of terbuthylazine technical and its formulations: collaborative study.** *J. Assoc. Off. Anal. Chem.* 64(4): 825-828; 1981 (5 references).

Terbuthylazine technical and its 80% wettable powder were analyzed in a CIPAC collaborative study. The content and the identity were determined by gas-liquid chromatography on a column of 3% Carbowax K20M on Gas-Chrom Q, using di-*n*-pentylphthalate as the internal standard. Results obtained from 27 government, university, and industrial collaborators showed within-laboratory repeatability of 1.3% for the technical and 1.0% for the wettable powder. Reproducibility was 2.1% for both samples. The method has been adopted official first action. (Author abstract by permission)

81-3281. Van Rossum, B.; Martijn, A.; Launer, J. E. (Philips-Duphar BV, NL-1380 Weesp, The Netherlands) **Gas-liquid chromatographic determination of tetradifon technical and formulations: collaborative study.** *J. Assoc. Off. Anal. Chem.* 64(4): 829-832; 1981 (3 references).

The gas-liquid chromatographic determination of tetradifon technical and formulations was collaboratively studied in duplicate with 12 laboratories. Six samples were dissolved in dichloroethane with *n*-hexacosane as the internal standard, chromatographed on a column of 3% SE-52, and detected by flame ionization. The average coefficients of variation were 1.2% for the 2 technical samples, 1.6% for the 2 wettable powders, and 1.5% for the 2 emulsifiable concentrates. The method has been adopted official first action. (Author abstract by permission)

81-3282. Albro, P. W.; Parker, C. E. (Lab. Environ. Chem., Natl. Inst. Environ. Health Sci., Research Triangle Park, NC 27709) **General approach to the fractionation and class determination of complex mixtures of chlorinated aromatic compounds.** *J. Chromatogr.* 197(2): 155-169; 1980 (27 references).

Among the inadvertent environmental pollutants are polychlorinated biphenyls, terphenyls, quadphenyls, naphthalenes, diphenyl ethers, dibenzofurans, dibenzo-*p*-dioxins and benzenes (including mirex and hexachlorobenzene). Mixtures of these classes of compounds also occur in commercial products such as transformer fluids. To analyze such mixtures, gas chromatography-mass spectrometry may be combined with prefractionation on basic and acidic alumina columns and semi-quantitative perchlorination techniques. These procedures are illustrated for synthetic mixtures as well as for 2 samples of stored transformer fluid. Although the described procedure is mainly intended to be applied to the characterization of the major class components of such mixtures, it is also applicable to the determination of trace components such as the dibenzofurans in commercial polychlorinated biphenyls. The mass spectra techniques permit the simultaneous patterning, or fingerprinting, of the compounds comprising each major class of chlorinated aromatics present. (Author abstract by permission, modified)

81-3283. Ullman, A. H.; Houston, R. (Proctor & Gamble Co., Sharon Woods Tech. Cent., Cincinnati, OH 45241) **Determination of residual epichlorohydrin in middle cut alkylglycidyl ethers by headspace gas chromatography.** *J. Chromatogr.* 211(3): 398-402; 1981 (9 references).

A method is presented for measurement of epichlorohydrin concentrations < 100 μg/g. Headspace (GC) was chosen because it is quite sensitive and reasonably interference-free. The fairly volatile epichlorohydrin was determined in the vapor above the high boiling glycidyl ethers, which are the main components of the sample. This simplified GC conditions by reducing analysis time and lowering column temperatures, and increased the sensitivity of the determination, compared to direct injection of the liquid sample. Adequate separation was attained with an isothermal program. To prevent possible carryover from run to run, the temperature was increased to 140°C at 32°C/min after 8 min at 80°C. Average analysis time was 20 min/sample. The limit of detection was about 2 μg/g based on a signal-to-noise ratio of 3. Use of a larger volume sample loop might lower this limit.

81-3284. Desmarchelier, J. M. (CSIRO Div. Entomol., Canberra, Australia) **A rapid, colorimetric, procedure for determination of fenitrothion.** *J. Environ. Sci. Health B* B16(4): 419-426; 1981 (3 references).

A procedure for the colorimetric determination of fenitrothion in formulations and in wheat, barley, starch, and yellow maize is described. The pesticide is hydrolyzed under reflux at room temperature in the presence of an alkaline peroxide to 4-nitro-3-methylphenoxide, and absorbance is measured at 398 nm. Extracts are filtered through basic alumina or barium chloride plus excess oxi-

dant to remove interfering substances. An alternative procedure, needing no initial filtration, is suitable for determining fenitrothion residues in starch and unground wheat or barley. The present techniques offer quantitative reproducible results, while substantially reducing the time needed for alkaline hydrolysis of the insecticide.

81-3285. Stein, E. R.; Carter, W. W.; Murray, A. T. (Subtrop. Prod. Chem. Res., Agric. Res., SEA, USDA, Weslaco, TX 78596) **A modification of imazalil residue analysis in treated grapefruit.** *J. Environ. Sci. Health B* B16(4): 427-437; 1981 (5 references).

Residues of imazilil, a postharvest fungicide effective against many citrus molds, were determined in grapefruit dipped for 30 sec in a 1000-ppm solution of the pesticide. Imazalil extracts from pulp, flesh, and peel were not derivatized with BSA but were injected directly into the gas chromatograph column for analysis. Imazalil residues were higher in the peel and less than 0.1 ppm in the flesh, except at 21 days post-treatment, indicating a slight penetration of the fungicide into the flesh. Recoveries of imazalil from fortified grapefruits ranged from 80.0-97.7% for the flesh and 77.0-113% for the peel. The present technique is recommended for use as a rapid and simple assay for routine analysis of imazalil residues in grapefruit and for determining maximum acceptable concentrations of this fungicide in fruits.

81-3286. Gaskill, Jr., A.; Jayanty, R. K. M. (Res. Triangle Inst., Res. Triangle Park, NC 27709) **A quality assurance program for determination of herbicides in estuarine waters.** *J. Environ. Sci. Health B* B16(4): 453-463; 1981 (3 references).

The US EPA requires all its grantees to participate in its new quality assurance program to ensure that all data resulting from EPA sponsored projects are scientifically valid. An evaluation of 2 grantee laboratories conducting field and microcosm studies on linuron and atrazine in Chesapeake Bay water was carried out. Quantitative or performance audit samples were prepared from stock solutions of spiked Bay water to test the accuracy and precision of the data being generated. Both of the laboratories achieved gas chromatographic analysis results that were within the error limits for original and stored samples of bay water spiked with linuron and atrazine. The system audits revealed acceptable sampling, extraction and analysis procedures at both of the laboratories. The analysis of 2 additional sets of quality assurance samples (one at the midpoint of the studies, the other at the conclusion) was recommended, along with a final systems audit of all notebook data and laboratory protocol.

81-3287. Wolf, M.; Deleu, R.; Copin, A. (Serv. Phytopharm., Fac. Sci. Agron., B-5800 Gembloux, Belgium) **Separation of pesticides by capillary gas chromatography. Part 2. Organophosphorus insecticides.** *J. High Resolut. Chromatogr. Chromatogr. Commun.* 4(7): 346-347; 1981 (11 references).

The high resolution of capillary columns greatly facilitates separation of a large number of organophosphorus insecticides. The separation of 26 organophosphorus compounds, including 2 metabolites and 3 isomers, is reported. The 26 organophosphorus species belong to 5 different chemical classes: phosphoric halides, phosphonodithioates, phosphorodithioates, phosphorothioates, and phosphates. The 2 metabolites were malaoxon and paraoxon. A Carlo Erba Fractovap 2150 with a Grob split-splitless injector was used in conjunction with a thermionic detector operating in the P mode. The capillary column only separated 3 of the organophosphorus compounds into their Z and E isomers: mevinphos, phosphamidon, and chlorfenvinphos. A limit of detection between 4 and 40 pg was obtained.

81-3288. Wehner, T. A.; Seiber, J. N. (Dep. Environ. Toxicol., Univ. California, Davis CA 95616) **Analysis of *N*-methylcarbamate insecticides and related compounds by capillary gas chromatography.** *J. High Resolut. Chromatogr. Chromatogr. Commun.* 4(7): 348-350; 1981 (7 references).

These chemicals were analyzed by means of capillary gas chromatography: methomyl, propoxur, Landrin (2,3,5-trimethylphenylcarbamate), molinate, terbutol, carbofuran, methomyl oximde, oxamyl oxime, oxamyl, matacil, mesuro, 3-hydroxycarbofuran, 3-ketocarbofuran, azobenzene, 1-naphthol, and sutan. Gas chromatography was carried out with a Hewlett-Packard 5710A, modified for capillary work with a split injector and detector make-up gas. Amounts injected were 0.5 to 2.0 μl, by the hot-needle solvent plug technique. For methomyl, which has 2 nitrogen atoms, the estimated limit of detection is about 0.2 ng injected, which corresponds to about 3 pg. Thus, it is clear that most *N*-methylcarbamates and some related thiocarbamates and oximes can be chromatographed with high efficiency and without thermal degradation. The limits of detection were compatible with the levels of chemicals anticipated in environmental samples.

81-3289. Ogierman, L.; Silowiecki, A. (Inst. Plant Prot., PL-44153 Sosnicowice, Poland) **Partition thin-layer chromatography of some triazine herbicides.** *J. High Resolut. Chromatogr. Chromatogr. Commun.* 4(7): 357-358; 1981 (9 references).

The results of thin layer chromatographic separation (non-reversed phase) for 2 chromatographic systems of the s-triazine herbicides are presented. Herbicides examined included simazine, atrazine, terbutylazine, propazine, simetone, atratone, secbumeton, terbuton, prometone, simetryne, desmetryn, ametryn, terbutryn, prometryne, methoprotryne, and aziprotryne. In 1

chromatographic scheme, the TLC glass plates were precoated and covered with silanized silica gel 60-F-254 and impregnated with 20% diethylene glycol solution in acetone. The mobile phase was *n*-hexane/benzene/tetrahydrofuran (4:1:1, v/v). In the 2nd chromatographic system, the same precoated glass plates were impregnated with 20% formamide solution in acetone and the mobile phase was *n*-hexane/chloroform/diethyl ether (3:1:1, v/v).

81-3290. Sauter, A. D.; Betowski, L. D.; Smith, T. R.; Strickler, V. A.; Beimer, R. G.; Colby, B. N.; Wilkinson, J. E. (US EPA, Environ. Monit. Systems Lab., Las Vegas, NV 89114) **Fused silica capillary column GC/MS for the analysis of priority pollutants.** *J. High Resolut. Chromatogr. Chromatogr. Commun.* 4(8): 366-384; 1981 (17 references).

The operational characteristics of fused silica capillary column (FSCC) GC/MS are presented as they apply to extractable priority pollutant analysis. Qualitative and quantitative properties of FSCC GC/MS analysis are presented for the analysis of standards and spiked hazardous waste extracts. Each of 3 laboratories examined the limitations of this methodology and the practical considerations of FSCC GC/MS analysis configuration. Chromatographic resolution, composite standard compatibility, analysis precision, dynamic range, quality control, and other considerations of the proposed FSCC configuration are discussed for use with spiked extracts of hazardous waste. Initial FSCC GC/MS experiments on standard solutions of acid extractable priority pollutants gave excellent qualitative and quantitative results. Two gas chromatographic problems encountered in this work involved column overload and double peaking. Advantages of using the GC/MS configuration include a reduced acquisition time for the determination of extractable priority pollutants, accurate and precise interlaboratory RRT values, low response factor variation, a linear dynamic range of two orders of magnitude, the potential for interlaboratory RF agreement for aromatic compounds, reduced quality control burden compared to GC/MS methods (which employ more than one GC column), and significantly improved data processing and data acquisition logistics.

81-3291. Landmann, A. W. (SLTC Tech. Comm., BLMRA, Moulton Park, Northampton) **Methods for the analysis for pickled pelts.** *J. Soc. Leather Technol. Chem.* 64(6): 121-123; 1980.

The qualitative detection of fungicides in pickled pelt is described. Diced pickled pelt is placed in a distillation flask with distilled water and sulfuric acid. The flask is then heated until 50 ml has been collected. The mixture of distillate and Folins and Ciocalteus reagent, and the subsequent addition of sodium carbonate, results in a blue color if phenols are present. The following commonly used fungicides give a positive test at this point: phenol, Nervan D, β naphthol, parachlorometacresol; faint positives are observed with pentachlorophenol (PCP) and 2,4,6-trichlorophenol. Paranitrophenol may not respond until a 1% ferric chloride is added to the residue, which will then produce a red violet color. To detect PCP and 2,4,6-trichlorophenol, chloroform is added to the distillate and shaken. The lower chloroform layer is separated into a test tube, to which distilled water and a few drops of copper/pyridine reagent are added. The development of a brown color indicates the presence of PCP or 2,4,6-trichlorophenol compounds.

81-3292. Pitt, W. W., Jr. (Oak Ridge Natl. Lab., Oak Ridge, TN) **Continuous monitoring, automated analysis, and sampling procedures.** *J. Water Pollut. Control Fed.* 53(6): 675-678; 1981 (63 references).

Monitoring strategies and sampling procedures for industrial effluents are reviewed. A comprehensive list of references to the literature on sampling and monitoring of wastewaters is provided. United States EPA guidelines and protocol are cited; approaches to wastewater monitoring reported in other countries are briefly noted. Types of instrumentation used in continuous monitoring applications are discussed; COD, BOD, dissolved nitrogen, heavy metal ion concentration, suspended solids, pH, temperature, pentachlorophenols, and fluorescence can be measured using a number of different on-line sensors in combination with computers. Biological monitoring systems often use fish, microorganisms, or enzymes as indicators of water quality; examples of studies using biological indicators are cited. Methods of automated analysis, increasingly important in monitoring water quality, are reviewed; sampling procedures and devices are described, and relevant references are provided.

81-3293. DePinto, J. V.; Young, T. C.; Martin, S. C. (Clarkson Coll. Technol., Potsdam, NY) **Aquatic sediments.** *J. Water Pollut. Control Fed.* 53(6): 999-1007; 1981 (140 references).

Recent advances in the analysis of organic substances in aquatic sediments are reviewed. Analytical methods and sampling techniques for detecting heavy metals, nutrients, biological activity, and organics, in sediments are discussed. Studies that correlate adsorption of aromatic hydrocarbons on sediments with linear partition coefficients, water solubility, organic carbon content, and cation exchange capacity are described briefly, and the role of adsorption as well as biological and chemical degradation in removal of contaminants from the environment is discussed. One study showed that the microbial breakdown of toxaphene in estuarine sediments was not a significant mechanism for the removal of toxaphene from the environment. Studies that present models of adsorption in aquatic systems are reviewed.

81-3294. Thieme, H.; Kurzik-Dumke, U. (Inst. Drug Res., Res. Cent. Mol. Biol. & Med., Acad. Sci. DDR,

Berlin, DDR) Gaschromatografische Bestimmung von Chlorpropham-, Metobromuron- und Chlorbromuron-rueckstaenden in Drogen des 2. AB-DDR. [Gas chromatographic determination of chlorpropham-, metobromuron- and chlorbromuron residues in medicinal herbs of the DDR 2nd AB.] *Pharmazie* 36(5): 386-387; 1981 (German).

A new gas chromatographic method for determining chlorpropham-, metobromuron- and chlorbromuron residues in ng quantities is described based on the bromination of 3-chloro-, 4-bromo- and 3-chloro-4-bromanilin resulting from the alkaline hydrolysis of the 3 herbicides. The resulting tribromo- derivatives are highly sensitive to determination by electron capture detection. The detection threshold of the method is 0.01 ng 2,4,6-tribromo trichloranilin or 0.05 ng 2,4,6-tribromanilin corresponding to 0.006 mg chlorpropham, 0.008 mg chlorbromuron, or 0.04 mg metobromuron. The method is claimed to be an improvement on the existing TLC method permitting only semiquantitative determination with ± 10% variability of results.

81-3295. Bhaskar, S. U.; Nandakumar, N. V. (Sri Venkateswara Univ., Dep. Zool., Tirupati 517502, India) Colorimetric determination of dimethoate or omethoate. *Talanta* 27(9): 757-758; 1980 (20 references).

A colorimetric method is presented for the determination of dimethoate or omethoate. Pig liver acetone powder is used as the enzyme source. *p*-Nitrobenzene diazonium fluoroborate is used as the chromogenic agent. The method takes 30 min to complete, including the time for preincubation. The procedure is sensitive and suitable for residue estimates in wheat and may find application in clinical, forensic and residue analysis. The amount of acetone in the reaction mixture until incubation is completed must not exceed 0.1 ml. This method is much more sensitive than non-enzymatic colorimetric methods, which have determination limits ranging from 50 μg to 1 mg. In this method inhibition can be detected at ng levels. Amounts ranging from 50 to 1000 ng of omethoate and from 1 to 10 μg of dimethoate can be estimated.

81-3296. Petrov, G.; Bachvarova, D. (Dep. Chem., Univ. Sofia, Sofia, Bulgaria) Kinetic method for microdetermination of the insecticide phosalone. *Talanta* 28 (7A): 481-483; 1981 (24 references).

The alkaline hydrolysis of phosalone results in *O,O*-diethylphosphorothioate and 6-chloro-3-mercaptomethylbenzoxazolone, which activate the copper(II) catalysis oxidation of hydroquinone by hydrogen peroxide in weakly alkaline medium. Phosalone and its alkaline hydrolysis products may form complexes with the reduced form of the catalyst which may be detected by IR spectra. The use of hydroquinone oxidation is suggested as a kinetic method for the determination of submicro amounts (0.005 ppm) of phosalone in foods and other products.

81-3297. Mestres, R.; Susilo, H. (Lab. Chim. Appl. Expert., Fac. Pharm., Montpellier, France) Recherche et dosage des residus de piperonyl butoxide dans les produits cerealiers. [Study and determination of piperonyl butoxide residues in cereal products.] *Trav. Soc. Pharm. Montpellier* 40(4): 277-284; 1980 (5 references) (French).

A gas chromatographic procedure for determination of piperonyl butoxide residues in cereals and flour is described. A 25 g sample of cereal is ground and homogenized. Isolation involves triple extraction with petrol ether (50:50), concentration in a vacuum, dissolution of the residue in acetonitrile, washing with petrol ether, dissolution in water and reextraction by petrol ether (extract A). Extract A is concentrated by evaporation and subjected to chromatography in a florisil column under usual conditions. Piperonyl butoxide is separated in the 2nd eluate and determined by gas chromatography with a flame ionization detector. The detection threshold is 200 ng. Recovery is 95-100%.

81-3298. Sheinina, R. I.; Prosmuchkina, L. V.; El'gort, V. M.; Beloborodova, N. F. (Author address not given) Opredelenie soderzhaniya butifosa v khlopkovom masle metodom gazozhidkostnoi khromatografii. [Determination of butiphos content in cottonseed oil using gas-liquid chromatography.] *Vopr. Pitan.* (3): 69-70; 1981 (7 references) (Russian).

A method for determination of butiphos (DEF) concentration in cottonseed oil is presented. Butiphos was extracted using codistillation on a glass column at 40-70°C using either n-hexane or petroleum ether as an extraction agent. Butiphos was identified by gas-liquid chromatography with a thermionic detector. A chromatogram of a standard solution of butiphos was compared to the cottonseed oil extract. Percent recovery for the method was 90-95%; the limit of detection was 0.1 mg/l.

81-3299. Tasaka, M.; Nagi, I.; Oka, H.; Sasaki, M. (Dep. Chem., Yamaguchi Pref. Inst. Hyg., Yamaguchi, Japan) [A simple method for determining orthophenylphenol and biphenyl on citrus fruits by high speed liquid chromatography.] *Yamaguchi-ken Eisei Kenkyusho Nempo (Ann. Rep. Yamaguchi Prefect. Inst. Hyg.)* 22: 107-109; 1979 (Japanese).

A simple and rapid method for determination of *o*-phenylphenol (2-phenylphenol) and biphenyl on citrus fruits was devised. Five g of finely cut specimen was homogenized and further disintegrated in a high speed blender for 1 min with 20 ml of methanol. After filtering, the residue was washed repeatedly with methanol and the washings were mixed with the extract. The mixture was filtered and subjected to a high speed liquid chromatograph (Shimazu LC-1 type). The column was a permaphase ODS of 1 m. The mobile phase was aqueous 30% methanolic solution for 2 min, then the concentration

of methanol was raised at a rate of 10%/min, and finally was changed to aqueous 50% methanolic solution for 15 min. Column temperature was 40°C and column pressure was 80 kg/cm². An ultraviolet detector at 254 nm for biphenyl and a fluorescent light detector for *o*-phenylphenol were used. *o*-Phenylphenol was recovered from the fortified lemons, oranges, and grapefruits at 95.7, 98.7, and 97.4% and biphenyl was recovered at 96.8, 97.4 and 93.4%, respectively. The detection limit (minimum) of the present method was 1 ng of *o*-phenylphenol and 10 ng of biphenyl.

81-3300. Kuhlmann, F. (Chim. Anal. Inst. Kuhlmann, D-6700 Ludwigshaften 14, BRD) **Rueckstandbestimmung von Pyrazon und seinen Metaboliten in Zuckerrueben. [Determining pyrazon residues and those of its metabolites in sugar beet.]** *Z. Lebensm. Unters. Forsch.* 73(1): 35-39; 1981 (10 references) (German).

A gas chromatographic method for determination of pyrazon (chloridazon) residues and its 2 metabolites, [metabolite A (pyrazon N-glucoside) and metabolite B (4-amino-5-chloro- pyridazon-6)] in sugar beet is described. Extraction is done with acetone. Separation of pyrazon and of metabolites A and B is done with chloroform. Subsequent purification of pyrazon is done by column chromatography. Metabolite A undergoes hydrolysis and purification by column chromatography. Metabolite B is separated by distribution chromatography, purified by chromatography, and methylated with a diazomethane solution in ether. Ether is used as a standard. The detection limit is 0.02 ppm. Recovery is 85-90%. While the herbicide and metabolite A are no longer detectable in harvested sugar beet, metabolite B is persistent and present in the beets in a concentration of ~0.04 ppm and in beet leaves in a concentration of 0.3-0.4 ppm.

See also 81-3001, 81-3007, 81-3008, 81-3009, 81-3011, 81-3032, 81-3036, 81-3086, 81-3089, 81-3095, *and* 81-3103, 81-3126, 81-3128, 81-3149, 81-3150, 81-3155, 81-3201 81-3220.

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